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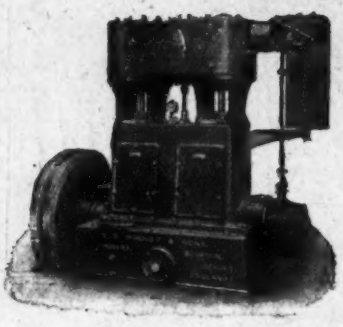

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THE
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THE TRAINING OF ENGINEERS.

ELSEWHERE in this issue we report the meeting which was held at the Institution of Civil Engineers last week, to form a "Central Organisation for improvement in and better co-ordination of Engineering Training." In this we see the culmination of a movement which has been in progress for many years, which has been accelerated by the lessons of the war, and which owes its successful issue very largely to the disinterested and indefatigable efforts of Mr. A. E. Berriman and Mr. A. P. M. Fleming, to whom the hearty thanks of the engineering world are due. The meeting was unanimously in favour of the proposition which it had been summoned to discuss, but which, by a curious departure from customary procedure, was not placed before it in the form of a resolution until most of the speakers had expressed their views. The adoption of the resolution without a dissentient voice was a foregone conclusion, and the scheme was launched with universal approbation.

The objects of the new Central Organisation can hardly fail to appeal to everyone who is interested in the welfare of the nation in general, and of the engineering industry in particular; the latter is essential to the former, and permeates the whole of our national life to an extent which can scarcely be realised by anyone who is not himself an engineer. Upon the maintenance of our position as an engineering nation depends our economic future in the coming industrial conflict, and it is of the utmost importance that every effort shall be made immediately to remedy the deficiencies in our methods of training engineers and securing the development of brains and talent *in all ranks*. We are glad to note, therefore, that the promoters of the scheme are fully alive to the necessity of providing for the adequate training not only of the engineer properly so-called, but also of the rank and file of the industry, whose functions are of equal importance to the State.

In point of fact, we doubt very much whether the facilities already provided in this country for the training of the engineer are greatly in need of improvement in themselves; many of our colleges are admirably equipped and staffed—the only respect in which they are deficient is in cheapness. Unless a youth can win a handsome scholarship, of which the supply is meagre, he cannot hope to follow the recognised curriculum and obtain a degree in engineering without imposing on his parents or guardians an expenditure which is prohibitive to all but the well-to-do. This is a grave defect in our educational system. No one would support the absurd contention that talent is confined to the progeny of the wealthier classes, and it stands to reason that many a boy of inherent engineering ability, or even genius, is either compelled to seek some other vocation less costly to enter, or, following his natural bent, is handicapped throughout his career for want of the training that his gifts deserve, and is unjustly condemned to a lifelong struggle to fulfil his true destiny.

A careful study of the three main objects of the scheme will show that, in fact, this fundamental principle underlies them all—help those who are worthy to help themselves. It is definitely crystallised in the third paragraph, which states what, in our opinion, is the most pressing need of all. We were exceedingly pleased, therefore, that Mr. Acland was able to state that, in spite of the post-

ponement of the Education Bill to the distant future, his successor at the Board of Education would shortly bring in as a measure of urgency a Bill to authorise the allocation of over £300,000 a year to this important purpose.

It will be recalled that so long ago as July last year the Consultative Committee on Scholarships for Higher Education, of which Mr. Acland was Chairman, in an interim report recommended that the Government should give grants in aid amounting to nearly £340,000 a year for the strengthening of the higher parts of secondary schools, for maintenance grants to scholars to enable them to receive higher secondary education from 16 to 18 or 19, and for scholarships to universities in scientific and technical subjects and research. The forthcoming Bill, no doubt, embodies these suggestions, and we trust that the Government will take care to smooth its path through Parliament, for the matter is too urgent to permit of further delay. While it is true that the sums referred to are not restricted purely to engineering, we have no doubt that a very large proportion will be allocated to that supremely important industry, and will go a long way (though still very far short of our true needs) towards meeting the third aim of the Central Organisation.

While we have dealt mainly with this item, we are in cordial agreement with the whole of the programme outlined, and we join with Mr. Acland and other speakers in welcoming the proposal to form an Information Bureau to which, like them, we shall be able to forward the inquiries which we are constantly receiving from "the perplexed parent whose son is approaching the completion of his last term at school."

Government "Control" of Trade in War Time.

The trade control methods that have been employed by the Government through its innumerable Departmental Officials during the war formed the subject of a very large and unanimous gathering held at Cannon Street Hotel on Thursday last week. Speaker after speaker insisted that they did not, of course, object to the principle of Government control in a time of such serious national emergency as is now upon us, but one and all of them did protest most strongly against the unbusinesslike way in which many of the restrictions have been imposed, and the incompetence and ignorance that have been displayed in carrying these restrictions into effect. Sugar, tea, leather, hay, dried fruits, metals, and paper were all in turn drawn upon by their respective experts or exponents to show how muddle has been caused in regard to each and all of them, and why? In the main because the Government has not seen fit to avail itself of the experience of the merchants and traders of this and other great cities in the country who have built up great business connections in all parts of the world because of their lengthy specialised and most intimate acquaintance with these particular commodities, and the procedure attending their purchase and import for home consumption. It was complained that in very few trades had the Government consulted the trades themselves in connection with such matters. Happily, the electrical trade was mentioned as one in which the exception had been made, but the feeling displayed by the representatives of the metal trades, which are the nearest allied section to the electrical, was very strong indeed. The arguments used do not, save in respect of this section, materially concern us as an electrical journal, but they certainly do appeal to us from the point of view of Governmental control generally. Our own pages have shown from time to time that even in the favoured electrical trades all has not been well when the Government hand has come down upon them, but in respect of commodities which came more directly in evidence at the meeting there was a procession of examples of colossal ignorance which had been shown, and blunders perpetrated, by officials who possessed no qualifications based on experience of the particular trade which they as Civil Servants, permanent or temporary, had "authority" to "control." The point needs no labouring. Under such conditions as obtain at present, control there must be, and it is for the Government to see that while it must last, in the interests of ourselves and our Allies, such control is imposed with efficiency and fairness, and by men who *know*, not by clerks who have to learn their business by groping their way through a forest of mistakes while incoming supplies are badly regulated, both as to quantity and as to port of discharge. Of course, there is another side to the matter. Tonnage accommodation, the need for independence and freedom from suspicion on the part of officials, and so forth, are factors of overwhelming importance. What seemed to enrage the merchants at Cannon Street Hotel more than anything else was the tendency shown by the Government to eliminate the merchant. They protest that they have done more than anybody else to build up our vast foreign trade, and that often they have to give credit and so produce business where the manufacturer will not give it. That the merchant has had in the past a large place to fill in our economic machinery, and that he will continue to do so, goes without saying, but the manufacturer of machinery for export markets has had to complain that the merchant at his foreign branches has not always helped British industry, but has far too often sent business to present enemy countries. The Government Commercial Intelligence representatives went to Birmingham and urged the brassmakers to combine or they would go under. Sir W. Ashley has also been to Birmingham on a similar mission. The merchants consider that the Government has thus exceeded its authority. Combinations of manufacturers dealing direct with foreign and Colonial markets through competent technical salesmanship might have little use for merchant assistance. The subject is a very large one, with many aspects, and it affects manufacturing industry as well as commerce. The merchants of the United Kingdom are preparing to make their voice heard unitedly in defence of their own interests. Their businesses in many cases are suffering owing to the hardness of the times, and they naturally resent being described as "parasites," but, while we have no sympathy with those who so describe them, we cannot dispose of so vast a question by means of a series of resolutions of protest forwarded to the Government. Furthermore, the protest can hardly help in the efficient conduct of the war when the Government is involved in such great difficulties every hour of the day. The control organisation is undoubtedly imperfect, and if it can be satisfactorily improved upon by enlisting the services of representatives elected by the trades affected the Government should repair the deficiency. But control itself cannot be lessened in such times as we are living in. The Cannon Street meeting was one of protest by men whose personal business interests have been affected, yet who must appreciate the manifest intention on the part of the Government to secure the safety of shipping and the sufficiency of food and raw material supplies, and to strengthen the spirit of unity among the people. Being a protest meeting, of course, one could not hear the other side. The Government case, if it could have been stated in reply, might have done something to temper the storm. The meeting decided to ask the Government to declare what its policy toward the merchant is going to be. We have our doubts whether our statesmen are yet prepared to define that policy in detail. So much depends upon so many things.

MESSRS. FULLER'S CARBON WORKS.

In addition to their manufacture of primary and secondary batteries and insulated wires and cables, Messrs. John C. Fuller & Son, Ltd., decided to establish new works for the manufacture of arc lamp and battery carbons, and the carbon factory has now been at work for several months. It is controlled by a subsidiary company, and is designed to produce all kinds of carbons for batteries, arc lamps, kinematographs, welding, &c.

From previous descriptions of carbon works which we have published, our readers will be aware that the industry is one which calls for a heavy outlay at the very start, owing to the necessity of laying down an elaborate and costly system of furnaces, and this feature no doubt has deterred many would-be manufacturers from incurring the risks attending an enterprise which cannot be inaugurated upon a modest scale—and which, moreover, before the war was subjected to intense competition by German and Austrian manufacturers. We are all the more pleased, therefore, to welcome the new undertaking as an additional guarantee of the establishment of the carbon industry in this country, and of our being self-contained in the future in respect of this most important industry, a "key" industry essential to the national safety.

Fig. 1.—Grinding and Mixing Machines.

The fundamentals of carbon manufacture may be briefly summarised as follows:—The raw materials usually consist of gas-retort carbon, soot, and tar. The carbon is carefully picked by hand to eliminate foreign material as far as possible; it is then crushed and ground to powder in ball or roller mills. The soot is specially manufactured by the incomplete combustion of oil, and the tar is of special quality. These three constituents are intimately mixed in steam-heated kneading machines and calenders, and the material is finally formed into cylindrical blocks for use in the hydraulic press. The latter extrudes the hot carbon mixture through dies shaped according to the desired product, and the rod or bar is cut into lengths of about 4 ft. as it comes from the press. These sticks become fairly stiff when cold, and are tied up in bundles, which are packed in fireclay crucibles with a filling of carbon dust to exclude air.

The furnace chambers are arranged in the form of a flattened ring, with ducts supplying producer gas between them, and flues to carry away the waste gases round the outside; by means of movable pipes and water-sealed valves in the roof of the chambers, gas can be admitted at any point, and, after combustion, carried into the flues. In order to avoid loss of heat, the waste gases are conducted through a number of the chambers before discharging them to the flues, thus warming up the chambers and their contents. By shifting the points of entrance and exit at regular intervals, it will be seen, the hot zone is gradually moved round the circuit of furnaces, each time bringing one or more cold chambers into operation, and removing a corresponding number of chambers from the active zone at the rear. The baking operation occupies a period of about seven days. The air required for combustion is passed through the chambers containing carbons which have been baked and are cooling down, thus recovering a portion of the heat and assisting in the cooling process.

The baked carbons, which are hard and ring when struck, are next cut to the appropriate lengths by a chopper machine, sorted, and flattened at the ends with an emery wheel. Carbons for magazine flame lamps are usually left flat at both ends; for open arcs and the Excello flame type they are pointed at one end.

The accompanying illustrations show some of the plant.

As the building of carbon-baking furnaces does not exist as an industry, it was necessary for the company's own staff to design and erect them; naturally many difficulties were met with, but were all overcome in turn. Much of the machinery had also to be specially made to their own designs.

The processes may be regarded as commencing with the manufacture of lampblack. The heavy oil from which it is derived is burnt in a pan about 4 ft. in diameter, with a limited supply of air; the products of combustion pass through iron flues into a series of large brick chambers, in which the soot is deposited. Periodically the operation is stopped, the chambers are cleared of foul gases by means of a motor-driven fan, and the lampblack is collected.

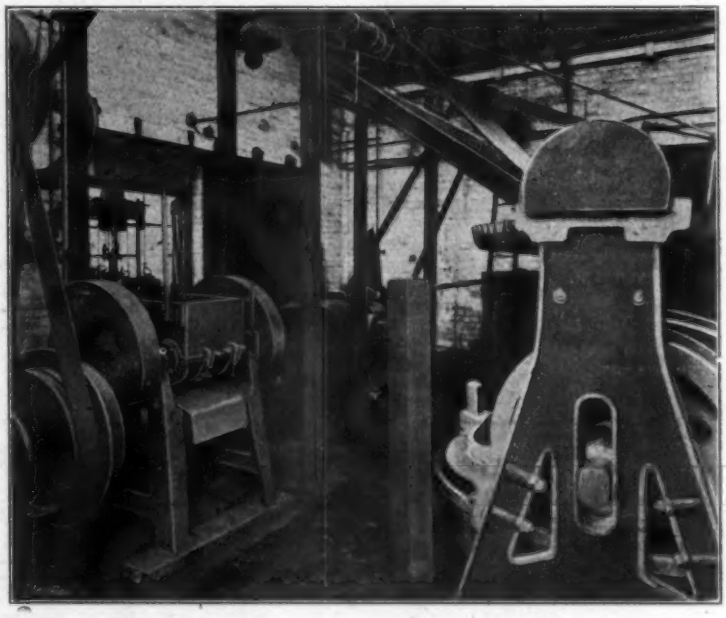

Fig. 2.—Mixing and Calendering Machines.

The company have a small paint works in operation, in which they utilise a part of the product of their lampblack plant, and doubtless this business will also be developed.

Figs. 1 and 2 show grinding, mixing, and calendering machines in the mixing shop, which prepare the materials for the press. Here the carbon is crushed in an ordinary

stone-crusher to the size of a walnut, after which it is passed through an edge-runner, which grinds it to coarse powder. It is finally put through the "fine grinder," which reduces it to powder, and is then ready for mixing with the other constituents.

Fig. 3 is a view in the press-room, showing a large

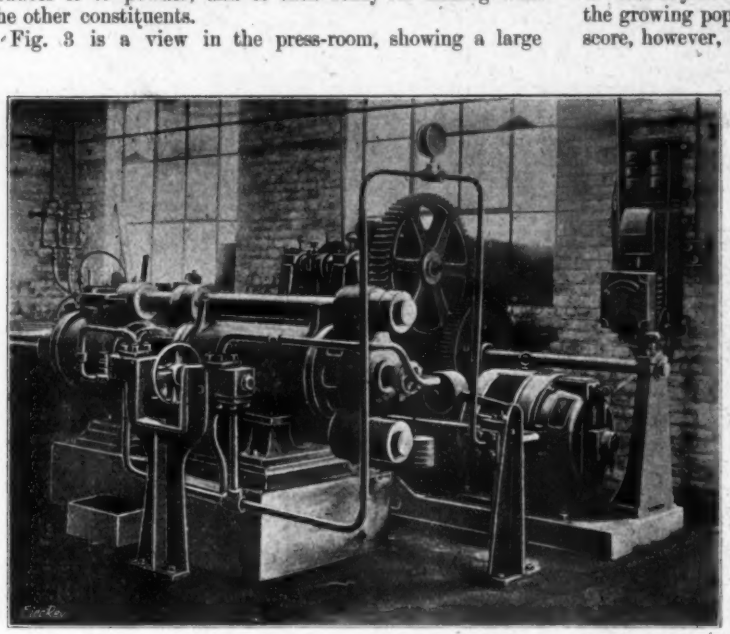

Fig. 3.—Carbon Press.

hydraulic press which, like all the other apparatus, is driven by an electric motor. The press motor is of 20 h.p., and was made by Messrs. Mawdsley's; all the rest are E.C.C. motors.

Fig. 4 shows the interior of the furnace-room, with some of the baking chambers open. At the far end of this building is the producer house, where fuel gas is generated from small coal in a producer of the Dowson type. The tapping holes for connecting the gas duct with the chambers, and the chambers with the flues leading to the chimney, are visible in this view.

While the demand for carbons for primary batteries, kinematographs, search-lights, and welding purposes, is certain to increase, it may be questioned whether the position of ordinary arc-lamp carbons is equally secure, in view of the growing popularity of the "half-watt" lamp. On this score, however, there need be no misgivings. While the high-efficiency incandescent lamp is unrivalled for many purposes, especially for indoor lighting, the flame-arc lamp of the magazine type (to which we refer nowadays when we speak of the ordinary arc lamp) remains by far the most efficient, economical and effective illuminant where large areas are concerned. Yellow flame 10-ampere arcs, with clear globes, give an "efficiency" on the basis of the lower hemispherical candle-power of 0·152 watt per candle, when clean, falling to 0·268 w./c.p. after burning for 100 hours. On the basis of mean spherical candle-power, the figures are 0·292 to 0·5 w./c.p. According to Mr. Maurice Solomon, from whose I.E.E. paper in 1912 these data are taken, while the cost of renewals, attendance, and depreciation of metal-filament lamps per 1,000 m.s.c.p. per annum is less than that of flame arc lamps by £2 4s., the cost of energy *at 1d. per unit* is less than £7 for the arc lamps and more than £18 for the metal-filament lamps, leaving a balance in favour of the arc of about £10 per annum. At higher prices for energy, the advantage of the arc lamp would be correspondingly increased. There is therefore no reason to suppose that the flame arc is approaching extinction.

For open and kinematograph arcs the positive carbon is cored. In this case the carbon rod is squirted from the press, with a hole in the centre, which is filled with the core material after the baking operation. For colourless arcs the filling consists mainly of alkaline silicates and finely-ground carbon powder; yellow arcs are produced with alkaline silicates, fluor spar, and carbon powder; for white flame arcs, cerium earth salts are substituted for

Fig. 4.—Interior of Furnace Room.

the fluor spar (calcium fluoride), and for red coloration strontium salts are used. In direct-current flame lamps, the flame material is usually inserted in the positive carbons only; for A.C. flame arcs both carbons are cored. Long carbons (over 15 in.) are fitted with a metal wire which passes down through the carbon to lower the resistance. This is a better plan than to copper-plate the carbons, which causes them to burn unsteadily. In the case of high-class kinematographs, the negative carbon is sometimes coppered, which enables it to be made of small diameter, and is provided with a solid core, 3 mm. in diameter, which produces a little pip on the end of the negative, and results in remarkably steady burning.

Although the factory has not yet been six months in operation, it is now being extended. We learnt with pleasure, also, on the occasion of our recent visit, that a canteen is about to be built for the comfort of the workpeople, taking the place of the existing temporary arrangements. On every hand there was evidence of progress and abundance of work, and in thanking the firm for the courtesies extended to us, we may add the hope that both during and after the war its affairs will continue to prosper.

ELECTROSTATIC VOLTMETERS.

By C. H. WRIGHT.

As a standard and also a readily-applied connecting link between direct and alternating voltages, a good form of electrostatic voltmeter is, without doubt, the best for commercial test rooms.

A suspended reflecting instrument of this kind *permanently installed* in a laboratory or test room runs little risk of mechanical derangement by accident, especially if the excellent plan of fixing standards permanently to a wall is adopted, as is done in most well-equipped laboratories.

The instrument can be checked quickly against a potentiometer by direct-current pressures, and by employing high non-inductive resistances with suitable tappings for the application of the voltages to be measured (the instrument being applied across a definite fraction) the range of a low-voltage instrument can be extended as required, a suitable multiplier being employed. The value of this multiplier is determined by the ratio of the whole resistance in use to that part of it across which the actual instrument is applied.

A well-constructed multicellular electrostatic instrument, being unaffected by changes of frequency or wave form or by magnetic fields in the neighbourhood, is especially suitable for use in a commercial test room as a standard of reference against which to check the working testing instruments for alternating-current work.

It is important to see, however, that an instrument of this class is of the best design and construction if for use as a standard of reference. In this connection the following note may be of interest:—

Some years ago the writer had some tests made in which a reflecting electrostatic voltmeter of unknown make was used. These tests showed anomalies which were ultimately traced to the voltmeter. The instrument was fitted with 10 aluminium vanes, attached to the spindle by means of aluminium wire pins, and had been in use in an atmosphere somewhat bad for electrical instruments generally, for about 10 years.

On testing it against a potentiometer on D.C., it was found correct, the largest error being less than one-half of 1 per cent., yet, as compared with a well-made hot-wire voltmeter on an alternating circuit, it indicated consistently lower, and the discrepancy was found to increase with increase of frequency, being about 3 per cent. at 60 cycles and 6½ per cent. at 100 cycles.

On D.C. both the electrostatic and the hot-wire instruments agreed with each other and with the potentiometer. The trouble was traced to the fact that two or three of the vanes of the electrostatic instrument were not in good contact with the stem to which the suspension was attached, and presumably owing to the high resistance between them and the stem, they required a definite time to become charged as fully as the other vanes. The oxidisation or corrosion of the very small aluminium pins was probably the cause of the trouble.

After efficient connection had been made between the affected vanes and the stem, the instrument became normal, and was correct on both D.C. and A.C. at all the frequencies available for testing at the time—namely, up to 130.

In the latest Kelvin low-tension electrostatic voltmeters the vanes are actually soldered to the stem, which is an excellent arrangement.

In electrostatic voltmeters for very low voltage it is desirable to have the fixed and movable elements of the same metal, as otherwise in calibrating with D.C. two sets of readings with reversed polarities are required, which involves extra labour, and is a precaution which may possibly be omitted on occasions.

This desirable feature is arranged for in low-voltage instruments by the best makers.

AMERICA'S EXPORT TRADE IN ELECTRICAL GOODS.

By MALCOLM CHALMERS.

THE ousting of German electrical goods from the world's markets and the restrictions which the war's demands have placed on British firms has been very beneficial to the electrical industry of the United States. It is not surprising, therefore, to learn that the year ended June 30th, 1917, the returns for which have recently come to hand, has been a record one so far as the exports of electrical goods are concerned, the value of such exports having reached nearly £11,000,000 in that year.

The following figures for the last four years show the progress that has been made since the war:—

Year ended June 30th, 1914	£5,312,000
Year ended June 30th, 1915	4,187,000
Year ended June 30th, 1916	6,399,000
Year ended June 30th, 1917	10,976,000

It will thus be seen that, as compared with the previous year, last year's figures show an increase of just over 70 per cent., whilst as compared with the last pre-war year the increase has been one of 105 per cent.

When we turn to the details we find that this increase has been fairly general, but that increases are especially noticeable in the case of batteries, wires and cables, metallic-filament lamps, electric motors, and telegraph and telephone instruments. On the other hand, exports of dynamos, transformers, and arc lamps were less last year than before the war.

In the subjoined statement details of the exports last year are shown in comparison with those for 1913-14, the last pre-war year:—

	1913-14.	1916-17.	Inc. or dec.
	£	£	£
Batteries	143,000	681,000	+ 438,000
Dynamos and generators ...	549,000	532,000	– 17,000
Fans	90,000	101,000	+ 11,000
Insulated wire and cables ...	415,000	1,498,000	+ 1,083,000
Interior wiring supplies (including fixtures)	150,000	234,000	+ 84,000
Lamps: Arc	16,000	3,000	– 13,000
Lamps: Incandescent:—			
Carbon-filament	36,000	33,000	– 3,000
Metallic-filament	46,000	446,000	+ 400,000
Meters or measuring instruments	*	216,000	+ 216,000
Electric motors	946,000	1,228,000	+ 282,000
Telegraph instruments (including wireless apparatus)	28,000	112,000	+ 84,000
Telephone instruments ...	324,000	407,000	+ 73,000
Transformers	303,000	263,000	– 40,000
Electric locomotives ...	91,000	110,000	+ 19,000
Other electrical goods ...	2,175,000	5,112,000	+ 2,937,000

* No information. The exports, however, in this year were probably quite small.

Of course, the increases shown above do not in all cases represent an increased volume of trade; some of it is doubtless due to inflated prices. After allowing for this factor, however, it must be admitted that the development has been phenomenal. Unfortunately, the returns do not show quantities, except for electric fans and lamps. In these cases, however, increases are shown in the actual quantities exported. Thus in the last pre-war year 32,816 fans were exported, valued at £2 15s. each; in 1915-16, 26,519, valued at £2 16s. each, were sent abroad, whilst last year the exports numbered 44,690, worth £2 5s. each. The exports of carbon-filament lamps in 1913-14 numbered 1,285,858, the average export value of which was about 7d. per lamp. In 1915-16 the number exported was 1,197,751, and the value about 6d. per lamp, whilst last year 1,341,444 of these lamps valued at less than 6d. each were exported. The increase in the case of metallic-filament lamps has been much more pronounced, as in 1913-14 only 849,261 lamps, valued at about 1s. 1d. each, were shipped abroad, whilst last year the number was 10,707,014, and the total value £446,000, *i.e.*, about 10d. per lamp.

Whilst on the subject of lamps, it is interesting to note that the United States does a large import trade in metallic-filament lamps, the figures for the last four years being as follows.—

1913-14	.....	6,925,753	.....	£114,154
1914-15	.....	6,240,173	.....	118,153
1915-16	.....	4,863,060	.....	146,208
1916-17	.....	7,664,746	.....	46,485

It will be seen that up to June, 1916, the imports were declining, but that prices were rising rapidly. Last year, however, the number imported increased by 50 per cent. over the previous year, whilst the total value was less than a third of the value in 1915-16. The figures are so peculiar that some explanation is necessary, though none is given in the American official returns. The most probable explanation is that whereas in earlier years the bulk of the imports consisted of ordinary lamps for house lighting, and came chiefly from the Netherlands, last year the great majority were miniature lamps for pocket flash-lights. It is known that Japan has been manufacturing this class of lamp in large quantities for the last year or so, and it is most likely that that country is the chief source of the lamps specified in the returns for 1916-17.

As regards the markets to which American electrical goods were shipped last year, no information is given in the returns, nor will they, in all probability, be available for some considerable time yet. From the record of past years, however, and an examination of the import returns of other countries, it appears that America does a world-wide trade in this class of goods, but that the principal markets at the present time are the United Kingdom, France, Italy, Canada, Australia, Central and South America, and Japan.

With regard to future possibilities, it would be useless to attempt a prediction. It may be that the American electrical industry will continue to improve its export position, but it must be remembered that in pre-war times Germany's export trade in this line was about 10 millions sterling, and that of the United Kingdom about eight millions. At the present time, Germany can be doing hardly any export trade owing to the difficulty of obtaining copper and other necessary raw material, to war demands, and the stringency of the Allied blockade. The United Kingdom export trade has also decreased considerably, the exports last year being valued at only £6,000,000, in spite of increased prices. Once the war is over, however, both Germany and this country will be active competitors in the world's markets once again, and it will remain to be seen to what extent America will be able to maintain her present position as the leading exporting country in electrical goods. It must be remembered, too, that Japan has entered the field as a manufacturer of this class of goods (see ELECTRICAL REVIEW, August 10th, p. 124), and although it will probably be some years before she will be able to compete successfully in other markets against the United Kingdom, Germany, and the United States, she will probably be able to retain the home market, which has hitherto been a good one for imported electrical goods.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The E.T.U. or the A.E.S.E.?

In asking you to afford us space in which to reply to the A.E.S.E. campaign of misrepresentation, we would point out that it was the intention of the promoters of the station branches of the E.T.U. to abstain from any criticism of the A.E.S.E.: but as this Association has thought proper to attack the station engineers' branches by a misrepresentation of the facts of the situation, we feel sure you will allow us to put our position before your readers. Mr. Ebben and the members of his Association were invited to join our organisation with a view to a common programme; he replied: "I am seriously considering the whole position"; this was about six months ago, since which no further communication has been received. Was it expected that we should forego our progress until his Association had decided what they would do? Instead of working for the common good of the station engineers, they opened a public attack on those who were, and are, seriously attempting to improve the conditions obtaining in this branch of the industry.

1. They state that we do not represent station engineers, when, as a matter of fact, we represent every electrical power sub-station and mains electrical grade, including the supervising grades of power station charge engineers, sub-station superintendents, mains engineers, &c., employed by over 40 of the largest power and lighting authorities; in London alone our membership is just under 1,000.

2. They publish a list of concerns which they purport to represent.

Let us take two of the concerns mentioned—viz., the L.C.C. and the North Metropolitan Electric Supply Co. Our membership on the L.C.C. is over 100; our membership on the North Metropolitan is over 50, and, moreover, we obtained the Engineering Award for our North Metropolitan members just recently.

3. In criticising our trade card, they state that the "A" card was not drawn up by technical men. "B" grades are mentioned, which do not exist, and grades which do exist are not included with reference to "A." This card was drawn up at a series of open meetings, attended by all station and mains grades, several of whom can write I.E.E. after their names; surely these would be counted as technical men.

With reference to "B," the grades not included are probably those mentioned by the A.E.S.E. appeal of October 19th; mains superintendent, mains assistant, meter superintendent, draughtsmen, testing engineer, installation inspector, commercial assistant, and publicity engineer. Apart from the fact that none of these designations are power station designations, they are really reiterations of the same, inasmuch as most of the supply authorities reduce at least five of these designations to one—viz., mains assistant, who is invariably the utility man.

4. They state that we have set a flat rate for engineers. No such suggestion appears on our card; what is claimed is a uniform minimum rate, and it clearly states that where the conditions are better they are to be upheld.

5. They state that "We suspended action during the war"; probably, but they did not fail to attempt to take full advantage of the Trade Protection Certificates, "Engineering War Awards," obtained as the outcome of action by us in conjunction with the other Engineering Unions.

We did not suspend action during the war, with the result that the attempt to patriotically (?) exploit wounded soldiers and sailors by engaging them for sub-station work at 25s. per week was stopped by our representatives on the National War Pensions Dilution Committee, who also established the precedent that, while not offering any objection to any soldier or sailor going into a sub-station, on no account was a pension to be regarded as part payment of wages. The justice of this claim was recognised by the Government; and, moreover, we have by our actions in numerous instances been the means of improving the station man's wages during the war, as can be observed on reference to the *Labour Gazette*.

The reprehensible tactics of this Association in the Technical Press are too obvious to need any comment from us; sufficient is it for us to notice that so appreciative are they of our progress that every move we make they follow, but never lead. The value of the Association is clearly stated by Mr. Ebben in the ELECTRICAL REVIEW of June 4th, 1917, when he states:—

"He seconded an amendment which was proposed by a member of the Electrical Trades Union at a meeting of electrical employers

and employés in London some years ago. This was the only time the electrical engineers took the A.E.S.E. seriously; as soon as the General Committee and members severed all connection with the E.T.U., the London chief engineers, being clever and far-seeing men, ignored the A.E.S.E. members, and have done so ever since, because they knew they had nothing to fear."

Any further justification for our present action is contained in the remarks of the Editor, ELECTRICAL REVIEW, September 28th, when he states:—

"We cannot recommend young men of ability and ambition to join the staffs of power stations, unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations as part of their technical training and not as a career."

In conclusion, it has been suggested that the E.T.U. are unpatriotic. This can be at once denied, as hundreds of our members are on active service, and are being kept in full benefit by the members at home, and on a ballot for continuance of the war, or against, an overwhelming majority voted in favour of continuance to a successful issue. It must be clearly understood that the E.T.U. is not ruled by any individual, but by a National Executive elected by all members in Great Britain and Ireland.

H. H. Morton,
Secretary of Station Engineers, No. 1 London Branch.

London, S.E.,
October 29th, 1917.

The article in your valuable journal, enclosing the letters addressed to Sir George Askwith, is lacking one thing, and that is Sir George Askwith's reply to the request for the A.E.S.E. to be represented at the next conference.

The following is the letter:—

[COPY.]

"Chief Industrial Commissioner's Department,
"Ministry of Labour, Montagu House,
"Whitehall, S.W. 1.
"*October 18th*, 1917.

"Dear Sir,—With reference to your letters of September 17th and October 16th, any further conferences will be held between the Unions by whom claims have been made and representatives of the Borough Councils, and I suggest that you should communicate on the subject with Mr. W. J. Webb, Electrical Trades Union, 76, Gray's Inn Road, W.C. 1.

"I am, yours faithfully,
"(Signed) G. R. ASKWITH.

"W. Arthur Jones, Esq., A.M.I.E.E.,
"Association of Electrical Station Engineers,
"26, Little Park Gardens, Enfield."

The notice as to the adjustments of rates and wages for the men employed by the St. Pancras Borough Council is also incomplete, as the following letter also shows:—

[COPY.]

"St. Pancras Borough Council,
"Town Clerk's Department,
"Town Hall, Pancras Road, N.W. 1.
"*October 26th*, 1917.

"Dear Sir,—With reference to your communication of the 16th of June last, I have to inform you that the Council have received a report from their Electricity and Public Lighting Committee, also a report from the Special Committee who have considered the question of the wages and war bonus paid to the employés of the electricity undertaking. The Council have revised the scale of wages for the employés of the electricity department, and I enclose for your information a copy of the revised scale.

"In addition to this, the Council are granting the employés of the electricity undertaking a war bonus of 15s. per week to those who are 18 years of age and over, and who receive a wage or salary of not more than £160 per annum, 7s. 6d. per week from £160 to £200, 5s. from £200 to £250.

"Yours faithfully,
"(Signed) C. BARRETT,
"*Town Clerk.*

"Mr. W. J. Webb,
"Electrical Trades Union,
"76, Gray's Inn Road, W.C."

The staff also of the North Metropolitan Electric Power Supply Co. have something to thank the Electrical Trades Union for, as the following letter will show:—

[COPY.]

"The North Metropolitan Electric Power Supply Co.,
"Electric Railway House,
"Broadway, Westminster, S.W. 1.
"*October 17th*, 1917.

"Dear Sir,—In reference to the conference which took place this morning at the office of the Industrial Commissioner, and to the subsequent interview which the general manager of the company and I had with representatives of your Union, I undertake that the company will, as from the week commencing September 1st, 1917, grant to the undermentioned grades (adults only) a war wage of 15s. a week, or such less sum as will bring up to 15s. a week the increase or increases in the wages granted since the outbreak of the present war, provided that where the wage of any man has been increased since the outbreak of the war by reason of his promotion to a higher or more responsible job, such increase is not to be taken into account in assessing the amount of the war wage.

"It is understood that the above arrangement only applies to weekly or hourly paid men.

"In regard to boys and youths under 18 years of age, the sum of 8s. a week is to apply in place of the 15s. a week above mentioned.

"*List of Grades:*

"Electrical fitters and their mates.
"Shift or charge engineers (senior and junior).
"Switchboard attendants (senior and junior).
"Electrical erectors.
"Wiremen and their assistants.
"Jointers and their assistants.
"Arc lamp trimmers.

"Will you be good enough to acknowledge the safe receipt of this letter?

"Yours faithfully,
"THE NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.,
"(Signed) JAMES DEVONSHIRE,
"*Managing Director.*

"W. J. Webb, Esq., *London District Secretary*,
"The Electrical Trades Union,
"76, Gray's Inn Road, E.C. 1."

The claim of the A.E.S.E. as being the Association to represent charge engineers is too laughable for words, and one wonders whether that is the reason that Mr. Ebben is no longer the hon. sec. From my personal knowledge of Mr. Ebben, when I was a member of the A.E.S.E., he would not stoop to the touting tactics now being adopted by certain engineers. Not touting for membership of the A.E.S.E., but touting (peaceful persuasion, one might almost call it) by engineers for Bill Smith (sub-station attendant) to say that the Electrical Trade Union does not represent him (Bill Smith), but the Electrical Trade Union is going on its way undisturbed, doing its best to obtain living conditions for station engineers of all grades.

W. J. Webb, *London District Secretary.*

London, E.C., *October 29th*, 1917.

The Prospects of the Central-Station Engineer.

To those who have followed closely the recent development of the Association movement amongst London power-station engineers, it must come as a great relief to realise that a serious crisis in their history has been circumvented. By how narrow a margin the situation has been saved, only those who have made it their immediate concern to steer the course can fully appreciate.

To get a true perspective, it is first necessary to view the relationship in which central stations stand to the engineering industry and to the war. It is in no sense an over-statement of the case to place power stations in the position of the hub of the engineering industry—the greater proportion of the efforts of which industry are directed into war channels. The full significance of this statement will be realised if the paralysis following a stoppage of all power-station output can be imagined.

The next step is to note how many engineers are responsible for the smooth and uninterrupted running of this hub. So far as London is concerned they number, not thousands, but just a few hundreds. Now picture the strength of the weapon which would be placed in the hands of an unscrupulous Association, Union, or Society. There is no need to labour the point—it must surely project itself right into the haziest vision.

To enlarge the perspective—what reward has accrued to those few hundred engineers, from chief to junior, who daily, during the past years, have shouldered increasing responsibilities and considerable additional work? They have seen outputs trebled and quadrupled profits beyond the dreams of avarice piled up on their industry, energy, and experience; and, let this not be forgotten, meanwhile nailed to the posts.

The exigencies of war demanded it, and they were content—content to see the market value of their stock-in-trade of experience depreciate 50 per cent.; content to rub along under conditions that would charge a Trade Union official with high explosive.

Trade Unions up and down the country did not sit still under the increasing oppressiveness, and all grades of war workers, by and around that gallant few hundreds, have been considered, and considered well. Moreover, some of those Unions were stretching a welcoming hand to those few hundreds—whether or no it was an interest with a single purpose is beside the point. The temptation was great.

The answer of those few hundreds to the overtures so made must redound to their ever-lasting credit, and it must be self-evident that they are made of the right stuff. The answer in effect was: This is our career—an engineer's career. True, the rewards for our industry and efforts fall lamentably short of the barest justice; but our career means more to us than the immediate acquisition of shillings. We prefer to adjust our own affairs, and will not allow any menace to the smooth running of the industrial career. The exigencies of war demand that some of those men are about to come under review by the London supply authorities. Is it too much to ask that a correct estimate be taken of their value—a true sense of appreciation formed of their action in banding themselves together—the preservation of their entity, and all that it means to the future of central station life, from chief to juniors? The gift of clear and expansive vision was never in greater demand amongst those about to mete out justice—not generosity—to those few hundred.

One of the Herd.

As a humble unit in central-station life, may I claim the privilege of tendering my thanks for the able manner in which you are supporting the much-discussed "engineer"? Moreover, your footnote to a letter of "Staff Electrician" in the issue of September 28th, has drawn an adverse criticism, in which the argument put forward is open to endless discussion.

The letter from your Manchester correspondent is the first of its kind up to the present, and, quoting the old adage that "Open confession is good for the soul," may we not confidently look forward to expressions of opinion from senior engineers, both London and Provincial?

A well-known business gentleman has stated recently that it is the old men who, at present, are running the world and the war, and we must not lose sight of the fact that the chief engineer of to-day is the same chief of the early days (in the majority of cases), and in these tumultuous times he has not had time to spare to carefully consider the immediate needs of his juniors.

The time has surely come when a member of the staff can approach his chief, and feel that he is not hampered in his quest by a fixed scale, and the usual referring to committee.

It has often been said that, if a position is not good enough for one, he should "get out;" is this always the right policy to pursue? And, to return to your correspondent's letter, he says: "Young men of ability and ambition are sorely wanted"—yes, and these young men will always be forthcoming, whose enthusiasm for their work often makes them forget the energy involved; are these men to meet the same reward as those who started years ago?

Engineer.

After reading through the correspondence on the militant organisation of power-station engineers, I am struck with the fact that the most salient feature of most of the writers is the emphasis which they lay upon "status." Surely it were high time that this nonsense was dropped. Status is a bogey which has been and always will be the enemy of democratic, and consequently real, progress.

The "superior technical staffs" may be very excellent people, and probably very clever too, but it never struck me that the mechanical routine of power-station operation was beyond the powers of any man of average intelligence and ordinary training; consequently, it is a source of amusement to observe the frantic efforts which the "Gabriels" of the recently resuscitated A.E.S.E. make in loudly trumpeting their patrician isolation.

The fact is quite clear that until the E.T.U. proved that they were alive, the "superior gentlemen" were still *ensommé*, and no doubt were waiting until post-war days before demanding an adequate wage to meet ferocious and continuously advancing prices. It is well to point out that the Labour movement in its new phase will need, and will get, men of capacity in its leading ranks. The superior brand of status-hunters will find themselves left completely frigid if they imagine that status will confer upon them any degree of effective force. They will learn that they must fight to obtain any improvement in salary, wages, or conditions, and a digest of any of the economic historians will prove to them that the fighting will be hard fighting too. It is beside the point to indicate the might of the organised medical and legal professions; these bodies have State protection—a bolster which no Government will be inclined to bestow further.

My advice to the authors of the long circular which secured free advertisement in the ELECTRICAL REVIEW columns, is to discard the "stilts" and come down to democratic terra-firma. As an electrical man in charge of a mere converting plant, I am no doubt offering impudent advice; but when I see the portents of increased centralisation of power supply, I think that many of the men at present numbered among the power station "superior" staff may be looking for jobs in competition with the sub-station charge or shift engineers who are so socially and technically "impossible."

W. F. K.

London, S.E., *October 28th*, 1917.

The Association Movement.

Although I have not recently had an opportunity of reading the ELECTRICAL REVIEW, I understand that a difference of opinion has arisen in your "Correspondence" columns concerning the origin of the Cable-Makers' Association.

As one who was present at the first meeting, I can say that all of those who attended that meeting have frequently referred to Mr. Henry Edmunds as the father of the C.M.A. At the same time, it is a fact that I was first approached, so far as the cable works at Charlton were concerned, by Mr. H. H. Berry.

F. S. Paterson,
Lieut. R.E. (T).

October 29th, 1917.

Apprenticeship in Electricity Supply.

I was interested to read in your issue of October 19th the course of training laid down for apprentices in the employment of your correspondent. Now, I think it is only fair to recommend parents of would-be apprentices who should be tempted to have their children bound to such luring employers to look before they leap.

As far as my own experience goes, I have been one of those who have been gulled by a similar advert. for electrical engineering apprentices. The fee was rather high (£50) considering that no pocket-money was allowed during the first 12 months, and also taking into account that my parents had to pay for my keep whilst out of home. The course of training was anything but near that laid down in my "indentures." Of the wiring work which was to consist of motors, heating and cooking apparatus, &c., I only saw two motors being installed during my term of apprenticeship, and I think three cookers was about the limit of our cooker wiring. Your correspondent explains what our wiring contracts were like when he says they were "not large." No they were not large—the largest was one of 20 lights. The extent of our modern instruments for mains and meter testing consisted of one antiquated P.O. bridge and a Megger for the former tests, and for the latter we had a unipivot dynamometer about 10 years old.

The plant consisted of two water turbines and an old-fashioned horizontal steam-engine which should have been scrapped A.D. 1900. The generators were A.C., Mordey Victoria, the newest of which, according to our cable jointer, who seemed to have been in the service of the company since its inauguration, was about 22 years old. The only mechanical repairs I saw during my term were the renewal of a few armature coils and the recasting of one generator bearing.

I also note what your correspondent says about the type of apprentice which they take on not being able to afford a mechanical training. Now, I would wish to ask him if for the fee he charges, (as I don't think he would be so kind as to give all his knowledge gratis), does he honestly think that any parent could make better use of his money than handing it over to the "manager of an electricity supply" that his son may obtain a knowledge of electrical engineering equal to, or if I might say so, less than that which may be had at any technical school at a less cost?

I do not wish to occupy too much of your valuable paper. I only wish to point out to parents of would-be engineers what a risk they take in having their sons apprenticed in a small power station where the manager distinctly states that the training is to be given as far as his knowledge goes. It would be far better for them to pay a little more at first and get their charges into a proper engineering firm, the owners of which aim at turning out engineers and who do not take on apprentices just because they wish to run their power stations cheaper than if proper engineers were employed.

Pro Bono Publico.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Drying Fruit and Vegetables by Warm Air from Turbo-Alternators, &c.

The Duisburg electricity station has erected a series of racks on which fruit and vegetables may be dried by the warm ventilating air escaping from turbo-alternators. This idea is due to the station engineer Fietz. The arrangement used is shown in the accompanying sketch. At the cost of a very small outlay, the staff and workpeople of the station have been enabled to dry a large part of their winter requirements of fruit and vegetables. The proposition deserves to be taken up by central-station engineers in this country. It should be possible, even at this late season, to add materially to the storable food supplies of the nation, and this without burning any additional fuel or incurring any serious capital expenditure.

The additional equipment required commences where the ventilating air leaves the alternator casing. The warm air, which

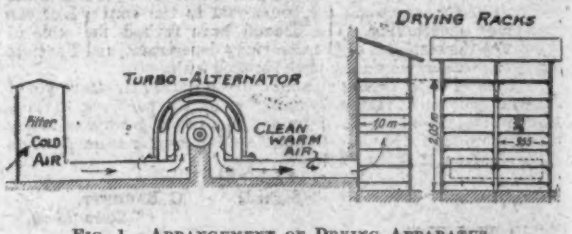

FIG. 1.—ARRANGEMENT OF DRYING APPARATUS.

is filtered as a matter of course before being admitted to the ventilating machine, is taken through a suitable duct to the bottom of a drying press, which consists of a sheet-iron enclosure containing a series of wire-netting drying trays. The top of the enclosure is open, but a roof is set about a yard above it to keep off rain and dirt. The drying trays are removable for filling and emptying, and provision is made for controlling the air flow. The sketch shows accommodation for 12 trays (2·05 m., or 6 ft. 9 in. in overall height) and the inside dimensions of each compartment are 1,000 × 955 × 300 mm. (about 39½ in. × 37½ in. × 12 in.). The trays, if not the rest of the iron work, should be galvanised to prevent rusting. About 22 lb. of vegetables can be dried in each tray, and from four to five hours is sufficient to dry vegetables or sliced fruit.

Condensing Plant.

An interesting catalogue (No. 58) of condensing equipment has just been issued by MESSRS COLE, MARCHENT & MORLEY, LTD., of Bradford, which covers many examples of independent plant suitable for turbines and reciprocating engines. The equipment is of the low-level jet, barometric jet and surface types. As regards the former, both the weir and nozzle patterns are supplied, and

the firm's patent vacuum breaker is fitted, which, in the event of the water in the condenser body rising above a predetermined level, operates in such a way as to admit air to the system until the vacuum is reduced and the working level regained, when normal working is automatically reintroduced.

In connection with surface condensing plants, Messrs Cole, Marchent & Morley are prepared to supply any of the recognised types of equipment, with either reciprocating or rotary pumps. In many cases the well-known Edwards type of air pump is adopted, but the firm are also building a well-known type of rotary air-pump, and as an alternative they are prepared to supply a double-acting horizontal dry vacuum pump, which can be designed with multiple stages, when very high vacua are desired.

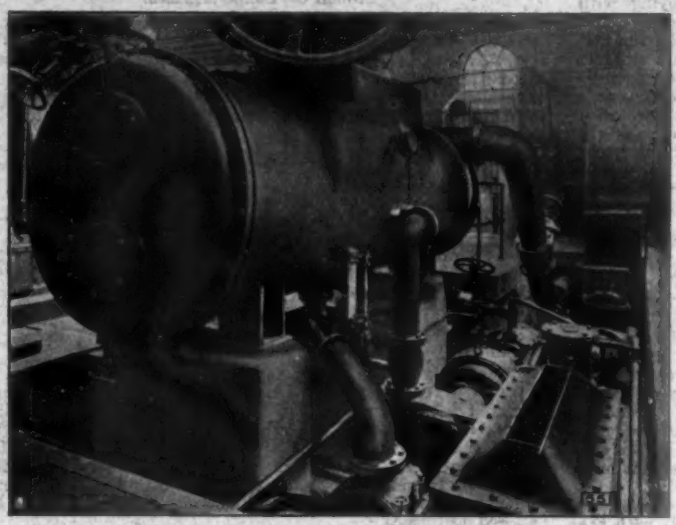

Fig. 2.—Cole, Marchent & Morley Condensing Plant.

The catalogue is well illustrated, and we select a view, fig. 2, showing a standard surface condensing plant, operating in conjunction with a 2,000-kw. turbine set. This condenser is, owing to special conditions, placed beside the turbine, and is provided with rotary air and extraction, and circulating pumps coupled to the same shaft and driven by an electric motor.

LEGAL.

The Osram-Robertson Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.—Appeal Allowed.

At the House of Lords, on October 25th, judgment was given in the appeal by the Osram-Robertson Lamp Works, Ltd., from an order of the Court of Appeal affirming a judgment of Mr. Justice Joyce in the Chancery Division. The action was brought by the present appellants to restrain the respondents, Pope's Electric Lamp Co., Ltd., from producing filaments of pure tungsten for use in electric lamps under a process which the appellants contended was an infringement of their Patent No. 23,899*, of 1904. Both Courts below held that there was no infringement, as the process used by the respondents was substantially different from the process described in the specification of the patent sued on, and the action was therefore dismissed with costs. The case was reported in the Electrical Review of July 2nd—23rd, 1915, and the hearing before the Court of Appeal in our issues of November 19th—December 31st, 1915. The appeal was heard on 10 different days, and judgment was reserved on July 9th.

Mr. Walter, K.C., Mr. Colefax, K.C., and Mr. Gray appeared for the appellant company; Mr. Thos. Terrell, K.C., Mr. E. M. Kirby, K.C., and Mr. E. Russell-Clarke for the respondents.

Their Lordships differed in opinion. The Lord Chancellor, Lord Atkinson, and Lord Parker were for allowing the appeal, while Viscount Haldane and Lord Parmoor were for dismissing it. By a majority of three to two the appeal was allowed.

The Lord Chancellor, in the course of his judgment, said:—The patent was granted to Alexander Just and Franz Hanaman. A patent had been granted to Welsbach (No. 1,535 of 1898) for the manufacture of filaments from osmium, and the method of manufacturing such filaments as described in his patent was adopted in the appellants' patent and applied to the manufacturing of filaments from tungsten. There can be no doubt that the application of an old method to a new substance may constitute a good subject matter for a patent if invention is required for the application. According to the specification, the tungsten or tungsten compound is to be mixed with an organic binding medium "such as collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide or the like." From the mass so formed filaments are to be formed in the usual manner. The filaments are then to be carbonised—that is, they are to be subjected to heat in the absence of oxygen as in the manufacture of charcoal, so that the other materials are driven off by destructive distillation and the carbon is left. The specification goes on to direct that the filaments are to be subjected to the following further treatment:—"First of all the carbon which has only served as a binding medium, is removed by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen, and thus raising it to a high temperature. By this means the carbon is completely oxidised so as to form carbonic oxide, and the filament of tungsten is left." It is mainly upon this last passage that the question of infringement depends, for the defendants do not heat the filament by passing the electric current through it but by the agency of external heat, and they do not subject the heated filaments to an atmosphere of steam and hydrogen formed *ab extra*, but it is alleged by the appellants that such an atmosphere is created *ab intra* by the heat, and that the respondents' process is in substance the appellants'.

In my opinion the respondents' process does amount to an infringement of the appellants' patent. The great merit of the appellants' patent consists in the discovery that tungsten can be successfully used for the manufacture of filaments for electric lamps. The respondents, like the appellants, used tungsten for this purpose, but say that they did so by a process different from that of the appellants. It was alleged by the respondents that the appellants used a "soft paste," there being a larger proportion of the binding material than of the metal, while the respondents use a "hard paste" composed of the metal with only enough of the binding material to act as a lubricant. It appears to me that the binding material is used as such in both processes, and that there is no ground for the respondents' contention that the filament is formed by them merely by the cohesion of the metallic particles under the pressure by which it is forced through the aperture. In both cases the cohesion is due to the presence of the binding material. On this point there is substantial identity between the appellants' patent and the respondents' processes. The filaments when formed are, according to the patent, to be "carbonised," and the respondents contend that there is no carbonisation by them as a distinct step. As a matter of fact, the respondents carry out carbonisation while the filaments are passing through the first furnace. In each case carbonisation is effected, and there is no material difference between the two processes on this point.

The serious contest on the issue of infringement was raised on the passage of the specification which describes the treatment of the filament by the passage of current in an atmosphere of steam and hydrogen. Upon this the respondents made two points. First, that there is no infringement, because they apply heat externally to the furnace, and not by passing the electric current through the filament; and, secondly, that they do not use an atmosphere of steam and hydrogen. It appears to me that the passage of the electric current was used in the appellants' process merely to produce a high temperature, and not for the sake of any other effect on the filament by the application of electricity, and that, in fact, it operated only by the production of a high temperature. It follows that if a high temperature be applied *ab extra* to effect the same purpose as by passing the filament through a furnace, the respondents cannot escape liability by this variation in the means used to produce the requisite temperature. In substance, the appellants' process is adopted on this point.

A more serious question was raised upon the point that the specification prescribes the use of an atmosphere of "steam and hydrogen," in which the filaments are to be raised to a high temperature, the respondents denying that they use any such atmosphere. It was admitted by the appellants that they could not succeed on this appeal unless it could be shown that the process of the respondents, in substance, consists in the application of an atmosphere of steam and hydrogen.

When the process described in the patent is carried out, the water forming the steam is decomposed by the carbon in the filaments and carbonic oxide is formed, so that ultimately the whole of the carbon is removed. At the same time the hydrogen liberated by the decomposition of the steam, as well as the hydrogen which forms part of the "atmosphere" prescribed by the specification, combines with the oxygen which is to be found in all commercial tungsten and forms more steam. In the result, the carbon disappears and a pure metallic filament of tungsten is left. The agent by which the carbon is removed is the water forming the steam, the oxygen of which, at a temperature of 700° C., or thereabouts, combines with the carbon. In comparing with this the process carried on by the respondents, although they are superficially different, I think the two are in substance the same.

His Lordship then dealt with the evidence given as to the two processes, and said that it was claimed by the respondents that there were advantages in their process which were not possessed by that in the terms of the patent of the appellants. He thought that was the case, and that there were improvements in a process followed by the respondents as compared with that under the patent. But the fact of improvements did not cure the fact that the respondents' process was substantially one which employed an atmosphere of steam and hydrogen. Upon the whole, he came to the conclusion that the respondents had infringed the appellants' patent.

It remained to consider the question whether the patent was valid, and his Lordship dealing with this point said :—

The objections are set out in the particulars of objections, and may be summarised as follows :—First, want of novelty ; second, want of subject-matter ; third, want of utility ; fourth, insufficiency, ambiguity, and misleading nature of description of process. The first and second of these objections, in my opinion, fail. The application of the Welbach method of manufacture to tungsten was new. Tungsten and its compounds were excluded by Welsbach from his patent, and it required invention and experiment to find out that this method could be successfully applied to tungsten. The third objection also fails upon the evidence, as there can be no question as to the utility of the invention. The fourth head of objection requires careful examination so far as it depends on the allegation that filaments cannot be made by employing with tungsten a solution of cellulose in cupreous ammonia oxide. This point depends upon the interpretation to be put upon the first sentence of the instructions in the specification. If that sentence is to be read as directing that either tungsten or any one of its compounds may be mixed with any one of the forms of organic binding material which are mentioned—viz., collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide—the patent would be bad. The solution of cellulose in cupreous ammonia oxide may be used with tungsten compounds, such as tungstite, tungstic acid, or tungstic sulphide, but not with tungsten itself. It follows that if the specification directs that it may be so used, the direction is misleading and the patent would be vitiated. In the present case the evidence establishes that it was well known in 1904 to everyone who had experience in making filaments that if cupreous ammonia oxide were used as a solvent for the cellulose, the result would be a failure if the metal tungsten were used with it. This was proved at a very early stage of the case by Dr. Passmore, a witness for the appellants. The fact that the cupreous ammonia solution of cellulose would act with all the enumerated compounds of tungsten is sufficient to support the language of the specification. Upon the whole, I think that the objection to the validity of the patent fails. I may add that if the language be ambiguous, a construction which will give effect to the patent is upon the authorities to be preferred to one which would nullify it. As, in my opinion, the patent is valid and infringement has been established, I think that this appeal ought to be allowed.

Lord Haldane's judgment (which was read by Lord Dunedin) was in favour of the appeal being dismissed. Having dealt with the facts, and compared the process as described with that proposed by Welsbach for application to osmium, he stated that the distinction between "hard" and "soft" paste was not material. The respondents did not heat their filaments by the passage of a current, and while in one of their processes they applied external heat in a current of hydrogen, there was no atmosphere of steam, as prescribed in the patent sued on. Even if hydrogen and water vapour were present in the way suggested, he did not think that they were present in such a fashion as to constitute such "an atmosphere of steam and hydrogen" as Just & Hanaman's specification directs to be employed. There might be present no steam at all excepting what the action of the hydrogen on the oxide of tungsten called momentarily into being. Any combination of hydrogen with oxygen which formed steam was brought into, and at once dissociated, by the new combination which its oxygen straightway formed with the carbon. No prepared atmosphere of steam was required or provided for. He was therefore of opinion that, so far as this aspect of the respondents' processes was concerned, it did not infringe the methods directed by the specification. Moreover, the respondents' mode of manufacture, unlike that of the appellants', does not require free carbon at any stage. The appellants' patent was one only for a process in which known factors were combined in a particular fashion. The novelty lay in the fashion of combination, and the fashion of the respondents' combination was of a substantially different character, to which the doctrine of equivalents had no application.

With regard to the question of validity, in his opinion the patent indicated a useful and patentable invention. But a question arose whether the practical directions which the specification gave were sufficient even for a trained lamp maker. It told those to whom it was addressed that they might take finely divided tungsten and mix it with cupreous ammonia oxide. It was admitted that this would not work. The instruction in regard to tungsten appeared to him to be unambiguous, and consequently fatal to the validity of the patent. For these reasons he thought that the appeal failed, and ought to be dismissed with costs.

Lord Atkinson read an extremely long judgment prepared by Lord Parker, who was for allowing the appeal. He said that he so entirely agreed with the opinion expressed by Lord Parker that it was unnecessary for him to deliver a separate judgment. He agreed in the appeal being allowed.

Lord Parmoor read a judgment agreeing with the opinion expressed by Lord Haldane.

On the motion of the Lord Chancellor the appeal was allowed, with costs, in the terms of the prayer.

Société Electricité de Paris v. Adam Bromley & Son, Ltd.

In the King's Bench Division, last week, before Mr. Justice Bailhache, plaintiffs brought this action against defendants, who are coal merchants of London, to recover damages for alleged breaches by the defendants of contracts for the supply of coals to the plaintiffs c.i.f. Rouen.

The case for the plaintiffs was that they were a large company with vast electrical power undertakings in Paris. They supplied electrical power to various tube railways, munition works and factories, and required to have some 500 tons of coal per day. When the supplies in France became depleted they had to make arrangements to get coal here, and they entered into various contracts with the defendants, breaches of which were now alleged. The defendants set up a variety of defences to the contention of the plaintiffs that they failed to make proper deliveries at the proper times. The defendants relied on the condition of things brought about by the war, and pleaded that the contract was ended.

Ultimately the case was settled in Court on terms agreed between the parties, the terms providing that the plaintiffs should have the taxed costs of the action, and that money should be paid out to them that they had paid into Court as security for costs.

House of Lords Appeal.

The appeal of the Metropolitan Water Board against the order of the Appeal Court reversing a judgment of Mr. Justice Bray, in the case between the Board and Messrs. Dick, Kerr & Co., Ltd., was before the House of Lords on Thursday last week. It will be remembered that the litigation related to contracts for the construction of reservoirs, the execution of which was interfered with by the Ministry of Munitions.

Damaging Electric Lamps.

At Dublin Southern Police Court, Eric Cantley, a boy of 15, was convicted, at the instance of the Pembroke Urban Council, of damaging public electric lamps and extinguishing the lights. He was ordered to find bail in £5, or, in default, to be imprisoned for a fortnight and to pay £1 compensation.

Kent v. Liverpool Corporation.

In the Liverpool Court of Passage, last week, Judge Taylor, K.C., gave his decision in an interesting case in which he had previously reserved judgment. The case was one in which Mrs. Caroline Kent, broker, of Wavertree Road, claimed damages from the Liverpool Corporation for personal injuries. The plaintiff was standing in the London Road, when part of the overhead tramway wire fell unexpectedly, and she received a fright or shock. She suffered some illness and was put to expense, and she claimed damages for alleged negligence.

His Lordship, in giving judgment, said it was clear that the general management of the overhead wires was without fault. The accident happened at what was known as a section insulator. There was a cap or cup, inside of which was a screw, and the accident would not have happened if the screw had not become unscrewed. For the plaintiff an expert suggested that the copper screw had not been tightened, and that it might have become unscrewed by passing traffic or vibration. The Corporation expert held that it was wrong to draw that inference, because it was extremely unlikely that their servant would be guilty of such a thing, and that one ought to assume that some accident had happened, such as a stone thrown by a boy, which had produced the unscrewing. It was not an ordinary case, and no accident of the kind had happened before. That was extraordinary when one considered the number of years the system had been working, and the number of section insulators.

His Lordship concluded that the mishap was much less likely to be due to negligence of Corporation workmen than to an accident. He was satisfied that it was not due to negligence, and he gave a verdict for the defendants.

WAR ITEMS.

Exports to China.—The "London Gazette" for October 30th contains a further list of bodies and persons to whom exports to China may be consigned.

Tar Oils.—An Order is published under which the Minister of Munitions will from November 1st take possession of all tar oils in the United Kingdom.

Leaving Certificates.—The question having arisen as to whether Section 3 of the Munitions of War Act, 1917, enables a workman who has undertaken the performance of a definite job to give a week's notice and leave before the completion of the job, the Minister of Munitions announces that he has been advised that the section does not apply to contracts of service for a definite period or for the doing of a particular job, but is confined to contracts which, apart from the Act, are determinable by notice or at pleasure. The answer is, therefore, that the section does not enable a workman who has undertaken the performance of a definite job to give a week's notice and leave before the performance of the job.—*Daily Telegraph.*

Reports received from several parts of the provinces go to show that the operation of the leaving certificates alteration is causing disquiet among the workers, because it is said that in certain cases men have been refused employment by one firm because they have left the employment of another. There are suspicions that employers in a district have agreed among themselves to prevent workmen leaving one shop and going to another. Trouble is threatened if this is proved to be correct. In one district it is complained

that men have travelled long distances in order to settle upon new work, by arrangement with a foreman, and have been dismissed after a few hours. Birmingham, Manchester, and several other places are mentioned as centres of dissatisfaction.

Coal Shortage in Russia.—The "Times" correspondent at Odessa states that since the revolution the miners in Russia have been working short time, and devoting their attention to politics. There has been a progressive decline month by month in output. The writer adds that "unfortunately wood cannot be used as a substitute for coal in the furnaces of many large factories, waterworks, electric light and similar works. The closure of these institutions would turn into the streets thousands of men. The serious character of the outlook is now recognised by the revolutionary authorities here, who have appointed a committee to deal with the question."

Trading with the Enemy.—The "London Gazette" for August 26th contains names of further bodies and persons with whom trading is prohibited in Argentina, Paraguay and Uruguay, Brazil, Chile, Ecuador, Greece, Morocco, Netherlands, Netherlands East Indies, Norway, Persia, Peru, Spain, Sweden, and Venezuela.

Engineers' Bonus.—With reference to the Order published in our last issue, the following official list sets forth certain occupations in which skilled men employed under the conditions prescribed in the Order are entitled to the bonus of 12½ per cent. Only those skilled men in the specified occupations who are paid at or above the current district time rate for turners or fitters are covered by the provisions of the Order:—Blacksmith, borer, coremaker, fitter, gauge maker, gear cutter, grinder, hardener and temperer, jig maker, miller, millwright, moulder, patternmaker, planer, shaper, slotter, toolmaker, toolsmith, turner.

Also skilled men employed in the following capacities whose trade is one of those specified above:—Charge hand, draughtsman, examiner, foreman, gauger, inspector, marker off, rate-fixer, setter-up, viewer.

Leaving Certificates and Electrical Undertakings.—Early in October, before the date for the abolition of Leaving Certificates, a deputation from the Tramways & Light Railways Association, the Incorporated Association of Electric Power Companies, and other associations, sent a deputation to the Ministry of Munitions to show the possible effect of such abolition upon their undertakings. As a result, a memorandum was submitted explaining the situation and advancing suggestions for meeting it. This memorandum appears in the October issue of the Tramways and Light Railways Association *Journal*. It was stated that the staffs of these undertakings had been heavily depleted already, and any alteration which might have the effect of still further reducing the labour necessary was viewed with the gravest apprehension.

The operations of electricity, tramway, and gas undertakings are carried on under Statute, and differ from those of many other industries which could restrict their output at their own discretion. They, however, were bound by Acts of Parliament to give and maintain their services. The memorandum continued:—

"Public service undertakings demand special consideration. Any insufficiency of the necessary labour will affect not our own concerns only, but will most seriously interfere with the output and operation of thousands of firms who employ many times more men than the public services, by stoppage of traffic facilities and supplies of electricity and gas used for power and other industrial purposes. It is understood that there is no possibility of the Government reconsidering the proposed withdrawal of Leaving Certificates, but we would suggest that the position would be rendered less difficult if it were possible to enact that the power of leaving should be limited to movements within each particular trade, and also that the period for giving notice of any proposed transfer of service should not be less than one month."

In case no modification of the abolition could be entertained the memorandum, in reply to the request of the Ministry, formulated suggestions for easing the situation:—

1. All skilled and semi-skilled men (and also unskilled men who have special training) who have been taken from public services to serve with H.M. Forces, should be restored at the earliest possible date.
2. The heavy burdens already put upon us by frequent increases in wages, and the possibility of further increases and alterations in conditions of employment now being demanded, should be met by giving to:—
   (a) Electric Lighting and Power Undertakings—authority to increase prices (if necessary above the present statutory maxima) by way of an adjustment of charges in proportion to the increased wages paid. This would entail amendment of existing long-time contracts.
   (b) Electric Tramway Undertakings—authority to raise or revise their fares, including workmen's fares.
   (c) Gas Undertakings—relief from the operations of sliding scale and maximum price regulations.

It was also recommended that in order to facilitate the work required of public service undertakings, higher class priority certificates should be issued for materials. This would have the effect, amongst others, of economising labour.

In the Parliamentary questions, Sir G. Touche asked the Minister of Munitions whether, in view of the abolition of leaving certificates, he had considered the question of protecting electricity undertakings from the danger of interruption arising from the loss of their men and consequent difficulties in the supply of electrical energy to munition and other works; if he was aware that his predecessor recognised the gravity of the position, and undertook that this aspect of the matter would be borne in mind on any amendment of the Munitions of War Act, 1915; and if he would say whether he proposed to take any steps in the matter.

Mr. Churchill, in reply, said he had received representations on this matter from the interests affected, and he was fully alive to the importance of their being able to retain or secure an adequate supply of labour. While he had no reason to think that the difficulties would be as serious as the representatives of these undertakings anticipated, he was prepared to take whatever steps were possible to meet such difficulties as might arise.

Exemption Applications.—In our report last week of the application respecting Mr. C. C. Hodges, we stated that he was doing the work of the Dawlish electric light concern with the aid of two pupils. What was actually stated at the Tribunal was that he *had been* doing the work. As a matter of fact, he was doing so for three weeks owing to inability to secure a stoker-driver. One had, however, been obtained some days before the hearing.

At Burnley, an electrical fitter, aged 29, B 1, was appealed for, his employer stating that he was the only man he had at present, whereas he usually had five or six. He was responsible for looking after the electrical equipment of several large works. The Tribunal thought the man ought to have a certificate, and they adjourned the case to the end of the year to enable him to get one.

Camberwell Tribunal have unanimously adopted a resolution, which is to be forwarded to the Army Council and the Local Government Board, protesting against the retention of young men in Woolwich Arsenal, fit for general service, whilst they were called upon to send into the Army men between 35 and 41 years of age, in low medical categories. The Military Representative said there was a certain amount of combing-out now going on at Woolwich Arsenal, as the Munitions Area Recruiting Officer was withdrawing certificates every week. Mr. May said it was about time something was done, for these young men were being granted protection by the M.A.R.O., doing work which could easily be learnt by older men in a very short time.

At Southwark, Mr. W. H. Donovan, a director of the London Commercial Electric Stores, Ltd., of 13, Farringdon Avenue, was summoned to show cause why his certificate of conditional exemption should not be withdrawn. He was 36 years of age, and passed for sedentary work at home (C 3). He stated that he did all the buying, and had been granted his exemption on domestic and medical grounds. He supported his father and mother, aged 74 and 68 years. They had a turnover at the firm of £30,000 a year. There was another director, who was a Czech. He stated that he had not joined the V.T.C. or the Special Police, although it was a condition of his exemption that he should do something of this kind. The Chairman: We asked you to do something—to make some sacrifice—but you have done nothing. Appellant said his business kept him fully occupied. Coun. Weaver: We can find work in the Army for C 3 men like you. The case was adjourned for a month to enable appellant to join either the Special Police or the V.T.C.

At a West Riding Appeals Tribunal, at Dewsbury, last week, Messrs. Ward & Co., electrical engineers, Dewsbury, appealed for B. H. Allen (23, Class A, married), electrical fitter, and for H. Hirst (31, A, single), skilled wireman. Mr. Nicholson, representing the firm, admitted that both men were young and fit, but so was the electrical trade young, and it was not likely that old men could be obtained to do the work efficiently. He contended that the local tribunal had been wrong in deciding that the men were not in a certified occupation, and he referred to the official list. Major Collins (Military Representative) said the latest instructions were that such men as these were needed in the Army. Mr. Nicholson said the firm were the only electrical engineering contractors left in Dewsbury, and were engaged in electrical installation at the military base hospital at Staincliffe, work which had been much delayed owing to labour scarcity. They had also contracts in mills and collieries. In reply to a suggestion by the Military Representative that the firm were not on the Government list, Mr. Nicholson said they were in communication with the Ministry of Munitions on that matter. The appeals were dismissed, but grace was allowed to January 1st in the case of Allen, and December 1st in the case of Hirst, both final.

Further exemption on business and health grounds was sought at Hastings by P. W. Bridger (28, B 3), electrician, engaged in his father's business. The Military opposed the appeal on the ground that applicant would be useful in the Army for electrical work. A final two months for a substitute to be found was granted.

Exemption until April 30th has been granted to H. W. Taylor (33, C 2), electrical engineer, of Leyton, who attends to the wiring, &c., at the Council schools.

At Colchester, an arrangement was arrived at whereby certain men in the Corporation tramway department should be released for military service. It was stated that 64 men had been parted with, and that the Tramway Committee hesitated to adopt a suggestion to employ female drivers owing to the gradients and heavy military traffic in the streets.

At Brierley Hill, Messrs. Holmes & Cartwright, electricians, asked for further exemption for an electrical engineer (28, C 2), the only one left capable of doing electrical work, and the only man in the district who could repair motors in local works. Three months were allowed.

At Kidderminster, exemption on the ground of being in a certified occupation was claimed by J. A. Mitchell (40, Class A), electrical engineer. Mr. Pilling, for the Military, said that after inquiry he was satisfied that appellant should have exemption, and conditional exemption was conceded.

At Quarry Bank, a works electrician (27) was appealed for by a firm of brush manufacturers. As he holds a red card, the appeal was respited *sine die*.

At Oxford, the Tramway Co. appealed for renewed exemption for M. F. Sadler (37, C 1), unit adjuster, and C. W. Millard (37, C 1), driver. The manager (Mr. A. A. Tyler) said that the men were absolutely necessary for the carrying on of the public service. Each was allowed three months' temporary exemption.

On a Military review, conditional exemption held by E. E. Hill (C 2), engine driver at the Winscombe electric supply station, has been cancelled.

At Axbridge, Mr. S. Hill appealed for the retention of P. J. Brown (30), Class A, in charge of the electrical plant on an estate at Churchill. He was stated to be of no value as a soldier. The case was put back for substitution, Brown not to be called up until a suitable substitute is found.

An appeal was made to the Herts. Appeal Court by C. E. W. Parker (18), second-year student for electrical engineering, and now engaged as electrical fitter and draughtsman with Messrs. Vickers, Ltd., Crayford. Exemption was refused.

Herts. Appeal Court have granted six months' exemption to M. J. Connari (38, B 2), electrician, of Watford.

Lancashire Appeal Court has refused an appeal by the Grove Dyeing Co., Littleborough, for the retention of J. Humphreys (26, Class A), electrician, and he is to report for service on November 30th.

Gloucestershire Appeal Court has dismissed a military appeal against the chief engineer to Messrs. T. B. Worth and Co., Thrupp, Stroud (34, A 1), responsible for the running of the electricity plant, and six months' exemption was granted.

BUSINESS NOTES.

An Exhibition in New Zealand.—Notwithstanding all the difficulties of the present export trade situation, there has lately been organised and held at Hawera, New Zealand, an exhibition of British-made goods. The exhibition is due to the initiative of Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, and its object has been to bring before buyers in that promising market manufactures made by British firms which will meet their requirements. The exhibition, which was well supported by agents and importers, included tires, hardware, tools, weighing machines, &c. It is hoped that other exhibitions of a like character will be held in other parts of the Dominion. As Mr. Dalton has shown in his reports, he attaches great importance to the matter of preparations during the war if we desire to secure and extend our hold on the New Zealand market. The present exhibition is a practical object-lesson of the advice that he gives. There can be no question about the future electrical importance of New Zealand, but British engineers will be required on the spot to show that British manufacturers are able to meet the market's needs, or else our disadvantages consequent upon the war will continue after the war, the advantage being gained by those who have now for some time reaped the benefit accruing to them from our occupation with munitions.

China Clay Combination.—It was stated at a meeting of the St. Austell China Clay Works, last week, that as the result of an agreement entered into with other china clay producing companies, with the exception of about 2 per cent. of the industry, there would be a great combination, which would ensure the regular distribution of the output of clay according to the capability of each company to produce it, and according to its quality of production. According to the *Times*, as a result the sale of the pre-war standard of the company's output was assured, as well as a fair and proper rate of wages, and the combination assured the master who had invested his money in china clay companies a fair and proper return for that investment. The result of the combine was that the price of their clay would immediately advance 33⅓ per cent., the supplies of coal from colliery proprietors would be regulated, and the china clay companies would be able to deal much better and more satisfactorily with the questions of railway transport and shipping facilities.

Book Notices.—"National Physical Laboratory: Collected Researches." Vol. XIII, 1916. London: Harrison & Sons. Price 20s. Also Report for 1916-17. From the Laboratory.

This volume of researches contains papers on optical apparatus, experiments on ship models, the hydrogen spectrum, the analysis of aluminium alloys, copper-tin alloys, and fuel oils, as well as one by Mr. Albert Campbell and Mr. D. W. Dye on "The Magnetic Testing of Bars" (I.E.E. paper), and one by Mr. F. E. Smith on "The Manufacture and Testing of Prismatic Compasses" (read before the Optical Society). An abstract of Messrs. Campbell and Dye's valuable paper has appeared in our pages. Mr. F. E. Smith's paper describes the tests applied to prismatic compasses for military purposes at the National Physical Laboratory, and discusses in detail the errors to which such instruments are liable, containing also a mass of information of use to the manufacturers of compasses. The report on tests of fuel oils, carried out for the Royal Commission on Oil Fuel in 1914, by Messrs. J. R. Pannell and W. F. Higgins, covers the flow of oil in pipes and the physical constants of the oils.

Cycling Manual. London: Temple Press, Ltd. Price 9d. net.—This little book fills a want long felt by the multitude of "users" of bicycles, who far outnumber the class who may fairly claim the title of "cyclists" and stand less in need of instruction and advice with regard to their mounts. It professes to tell "all about cycles and cycling in simple language," and, so far as the choice, care, and repair of the bicycle are concerned, it fully attains its object. After an interested perusal of the whole of its contents, we are of opinion that no one who rides a bicycle should be without a copy of it.

"Terms of Industrial Peace." By A. Ramsay. London: Constable & Co. Price 3s. net.

"Power Wiring Diagrams." By A. T. Dover. London: Whittaker & Co. Price 6s. net.

"Continuous-Current Motors and Control Apparatus." By W. P. Maycock. London: Whittaker & Co. Price 6s. net.

"British Standardisation Rules for Electrical Machinery." Report No. 72 (1917) of the British Engineering Standards Committee, revised September, 1917. London: Crosby Lockwood and Son; or the Committee. Price 1s. net. (See our "Notes" columns to-day.)

Trade Statistics of Spain.—The figures given below show the imports of electrical and other similar goods into Spain during the year 1916 according to official statistics. The figures for 1915 have been added for the purposes of comparison, and increases are also shown. The detailed returns giving countries whence the goods were imported will probably not be available for some months:—

	1915. Pesetas.	1916. Pesetas.	Inc. or dec. Pesetas.
Arc lamps	14,000	16,000	+ 2,000
Carbons for arc lamps ...	33,000	6,000	— 27,000
Incandescent electric lamps, mounted ...	2,420,000	2,218,000	— 202,000
Ditto, unmounted ...	34,000	7,000	— 27,000
Dynamos, electric motors, induction coils, resistances, transformers, &c., up to 100 kg. weight	1,847,000	2,351,000	+ 504,000
Ditto, weighing from 101 to 400 kg.	937,000	1,731,000	+ 794,000
Switchboards and interrupters, up to 400 kg. weight	312,000	576,000	+ 264,000
Dynamos, electric motors, &c., and switchboards, weighing from 401 to 2,500 kg.	1,076,000	2,339,000	+1,263,000
Ditto, weighing from 2,501 to 5,000 kg. ...	560,000	392,000	— 168,000
Ditto, weighing more than 5,000 kg. ...	1,804,000	2,369,000	+ 565,000
Accumulators and electric batteries	98,000	150,000	+ 52,000
Cables and electric wire with or without insulating material, of 1 cm. diameter or more ...	155,000	123,000	— 32,000
Ditto, less than 1 cm. in diameter	127,000	121,000	— 6,000
Telegraph and telephone apparatus, electric meters and parts ...	2,444,000	4,688,000	+2,244,000
Electrodes	63,000	79,000	+ 16,000
Hydraulic motors ...	1,627,000	1,119,000	— 508,000
Steam and gas engines (stationary) up to 10,000 kg. weight ...	545,000	607,000	+ 62,000
Ditto, from 10,000 to 25,000 kg. weight ...	49,000	200,000	+ 151,000
Ditto, over 25,000 kg. weight	250,000	360,000	+ 110,000
Cylindrical boilers ...	156,000	141,000	— 15,000
Multitubular boilers ...	1,801,000	2,355,000	+ 554,000

Lamp Prices in Germany.—The German Association of Electric Lamp Manufacturers has recently issued a new price list, which shows an advance of 40 per cent. in the price of metal filament lamps and of 20 per cent. in those of carbon filament lamps.

Trade Inquiries.—H.M. Consul-General in Paris states that an agent there desires to get into touch with United Kingdom manufacturers of railway material, electrical appliances, &c., with a view to obtaining agencies for trade after the war. Inquiry No. 369, Department of Commercial Intelligence, 37, Basinghall Street, E.C. 2.

Catalogues and Lists.—The B.E. Co. (of London and Birmingham), Ltd., Mansion House Chambers, Queen Victoria Street, London, E.C. 4.—Two leaflets, one giving net prices for non-association V.I.R. cables, the other describing the "Beco" dimmer. Copies will be sent on application.

Patent Application.—The Menno Lubricator Co., Ltd., has applied for restoration of Patent No. 27,131, of 1905, granted to J. F. Lewis for "Improvements in Automatic Grease Cups."

Liquidations.—In the Chancery Division, last week an order was made for the winding up compulsorily of the GOLDSCHMIDT, LTD., which has already been ordered to be wound up under the Trading with the Enemy Act.

UNITED CARBORUNDUM AND ELECTRITE WORKS, LTD. [Enemy Company].—The last date for creditors' claims to be sent in to the controller, Mr. C. Eves, 62, New Broad Street, E.C., is November 30th.

Lantern Slides.—MESSRS. ED. BENNIS & CO., LTD., inform us that they have a large number of lantern slides dealing with the development and present practice in connection with automatic stokers, coal elevators and conveyers, &c., which they will be pleased to loan to any responsible inquirer for lecture purposes. A set of slides on the subject of ash removal is in course of preparation, and will be ready shortly. A list of the slides and particulars of their subject matter can be obtained on request. Applications should be made as far as possible in advance of the lecture date to Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1.

Trade Announcements.—MR. A. E. BLOWER has resigned his position with the Wandsworth Electrical Manufacturing Co., Ltd., by mutual agreement, after many years' service with the company, and has commenced business on his own account, in company with Mr. A. Cooper, under the style of Blower & Cooper, electrical and engineering suppliers, having purchased the business carried on for some years by Messrs. Cooper & Roberts, at 3, Paul's Bakehouse Court, Godliman Street, E.C.

By permission of the Ministry of Munitions, and by order of the trustee, the stock-in-trade of MR. B. C. COUSINS, electrical and nautical contractor, Wyre Dock, Fleetwood, has been disposed of by auction.

Bankruptcy Proceedings.—R. E. CONNOLD, late electrician, now R.N.A.S., Canterbury.—Trustee released July 27th, 1917.

A. E. FELGATE, electrical engineer (late trading with W. Storey as Felgate & Storey), Reading.—November 22nd is fixed for hearing application for debtor's discharge.

Sterling Fire Brigade at Work.—On Friday last an outbreak of fire on property near the Sterling Works was promptly overcome by the swiftness of the fire brigade connected with the Dagenham works of the STERLING TELEPHONE AND ELECTRIC CO., LTD. The managing director, Mr. Guy Burney, superintended the efforts of the amateur firemen, assisted by Mr. A. Crawford, and others. Had it not been for the alertness of the brigade, in all probability a whole row of cottages would have been burnt to the ground; as it was the damage was confined to some stables and store-houses.

LIGHTING AND POWER NOTES.

Accrington.—PRICE INCREASE.—The Electricity and Tramways Committee has decided to advance the charge for current, in order to meet the greatly increased cost of production. Where the consumer is on the rateable value system, and also where current is used for heating purposes only, 10 per cent. is to be added to the consumer's account each quarter. A similar addition will be made to the charges in the case of power users not affected by the sliding rate regulated by the price of coal, whilst power users under agreement are to be charged at the increased rate of '06d. per unit, in addition to the increase owing to the advance in coal prices.

Argentina.—A strike of the stokers and engine-room staff employed at the South Dock power station of the German Trans-Atlantic Co. recently occurred, which also spread to the company's power station at Boca, and to the employés of the tramway running to South Dock. The company appealed to the municipal authorities, who secured the services of a naval force to operate the power plant and guard the station. The *Review of the River Plate* contrasts the prompt action of the authorities in the case of this German company with their attitude during the recent railway trouble, when, after considerable delay, the troops sent were unable to prevent considerable damage being done. Owing to the strike the Anglo-Argentine Tramways Co. had to reduce its services between 5 and 9 p.m.

Bedford.—The mains are to be extended to the works of the Cryselco Co., Rogers' Flour Mills, English Bros., and Hobson and Co., and an additional cable provided for the Queen's Engineering Works. The cost in the case of the Cryselco Co. will be £3,835, and the company is to be asked to pay £2,420 and guarantee at least £550 per annum for seven years.

Belturbet (Co. Cavan).—A dispute with regard to the electric lighting supply has been settled by the Council agreeing to pay the contractor's terms for the season, £70. Fears were entertained that the power plant might be removed if the dispute continued, and protests were made at a ratepayers' meeting.

Bradford.—PRICE REVISION.—Last week the Electricity Committee, after a lengthy discussion, reaffirmed its proposed revision of electricity charges (previously enumerated in the ELEC. REV.), which were referred back to the Committee by the City Council on October 9th; the proposed charges have been re-submitted for approval. The chief objection at the Council meeting was the proposed raising of the charge to the 4d. flat rate consumers; the Council decided to defer the matter for three months.

The Electricity Committee has authorised the Town Clerk to protest, on the Committee's behalf, that it is unfair that the increased price of coal for works is retrospective to September 17th, and to urge that the advance for works be brought into line with that for household purposes, and be retrospective, therefore only to October 15th.

Permission has been obtained to proceed with the provision of a coal conveyor at Valley Road works.

Brighton.—The electrical engineer reports that he has been in negotiation with Messrs. D. Selby-Bigge, for the sale of two disused boilers at the North Road works, at £1,900. These boilers cost £2,150 in 1901. The Electricity Committee has decided to agree to the sale at the price mentioned.

Burnley.—PRICE INCREASE.—The Electricity Committee has decided to recommend the T.C. to increase the price of electricity by '12d. per unit for power and traction, and ¼d. per unit for lighting.

Continental.—FRANCE.—A new company has lately been formed at Toulouse with a capital of £60,000 and the title La Société l'Electro-Metal, to acquire the rights to certain waterfalls near Griff, in the Upper Pyrenees, to establish a hydro-electric plant to utilise the same in the generation of electrical energy, and to establish works for the electrical production of ferro-silicon.

ITALY.—The impossibility of procuring coal at the present time has brought about the bankruptcy of the Società Anonima Lucana di Industrie Elettriche, at Salerno. The company was formed in 1913 with the object of generating and distributing electric energy at Valla Lucana. This company is to be distinguished from the Società Lucana per Imprise Idroelettriche, of Naples, which generates its current from water power obtained from an artificial lake or reservoir built and leased by the State, the only instance of its kind of the Italian Government helping the electrical industry. —*L'Elettrotecnica.*

Owing to the scarcity of labour, the Società Mineraria ed Elettrica del Valdarno, Florence, has found it impossible to finish the projected 7,000-volt transmission line which was to bring energy from the hydroelectric station at Terni. The company, however, contemplates carrying out other hydroelectric installations, on which some 6,000,000 lire are to be expended.

Croydon.—YEAR'S WORKING.—The report of the 20th year's working of the Corporation electricity undertaking shows a net increase in revenue of £2,586, but an increase of £2,739 in working expenses. The net loss on the year's working is £1,690. The units sold totalled 8,258,778, an increase of 290,544 over the previous year. Electricity to the value of £203 was supplied free to hospitals, convalescent homes, &c. Coal cost £3,646 more than the year before, and the heating value per ton (says the borough electrical engineer) has seriously deteriorated. The purchase of a 4-ton electric lorry has resulted in a saving in haulage charges equivalent to £250 a year. Of the 51 men of the department who have joined the Army four have been killed.

Edinburgh.—YEAR'S WORKING.—The annual accounts of the Corporation electricity undertaking show that 18 million units were sold, practically half being for power purposes. The total revenue was £142,611 and the gross surplus £59,250; after meeting the usual loan charges, taxes, &c., there remains a deficit of £4,726, which was provided out of reserve, the latter fund now having a balance in hand of £100,172.

Falkirk.—PRICE INCREASE.—The T.C., in view of the increase of 2s. 6d. per ton in the price of coal, has raised its charges for gas and electricity for the second time within a month. For electricity charges for lighting are increased by ¼d. per unit, and for power purposes by '075d. per unit.

Gillingham (Kent).—The T.C. has rejected a recommendation by the Electricity Committee to further increase the charges for current by 10 per cent., in addition to the recent advance of 15 per cent.

Glasgow.—PRICE REVISION.—At a meeting of the Sub-Committee on Finance of the Electricity Committee, the engineer intimated that the Controller of Mines had authorised an increase in the price of coal by 2s. 6d. per ton at the pit mouth from 17th ult., and he reported that this would entail on the electricity department an additional expenditure on fuel for the current year of about £25,000, to meet which an increase in the charges for electrical energy would be necessary. The Sub-Committee agreed to recommend that the charges for motive power purposes be increased 7 per cent. as from and after the date of last survey. At a subsequent meeting of the Electricity Committee this decision was rescinded, and it was decided to recommend the T.C. that the charges for all purposes be increased by '075d. per unit as from and after the date of the last survey. H.T. mains are to be laid from the new electricity works at Dalmarnock to St. Andrew's Cross works.

Greater London.—ELECTRICITY SUPPLY.—Meetings have been held of the conference of local authorities owning electricity undertakings in Greater London. At the first meeting 24 authorities were represented by 42 delegates. It was resolved—"That the Electric Power Supply Committee be requested to hear evidence from the conference with respect to the supply of electrical energy in Greater London by local authorities." It was

further resolved to appoint a Committee consisting of three municipal representatives, three town clerks, and three engineers, to prepare evidence, one of each to be elected from the Outer London authorities. On the invitation of the L.C.C. Special Committee, it was decided to appoint delegates to meet the L.C.C. Committee to discuss the situation created by the conclusions arrived at by the Board of Trade Committee. It was resolved that each local authority represented at the conference be asked to subscribe the sum of two guineas towards the expenses of the conference. At further meetings it was reported that the B. of T. Committee had agreed to hear one witness. It was resolved that the Committee be again asked to hear three witnesses—viz., one municipal representative, one town clerk, and one engineer, and the three witnesses suggested were appointed. It was stated that the L.C.C. Special Committee desired representatives of the Outer London authorities to be included in the delegation, and representatives from the following authorities were elected—viz., Croydon, Erith, Ilford, and Walthamstow.

Halifax.—At the T.C., last week, there was criticism on the bill of charges presented in the accounts of the Electricity Committee for the services of Sir John Snell, as adviser in connection with the purchase of the site at Copley with a view to expected power station developments in the future. The item was £112, which, it was contended, was excessive. Upon a vote being taken, an amendment referring the item back to the Committee was carried by 20 votes to 19.

Heywood.—Price Revision.—In view of the increased cost of coal, &c., it has been decided to advance the charge for current for power purposes from January 1st next.

London.—L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £4,500 by the Poplar B.C. for the provision of an electricity sub-station, and of £2,088 by the Woolwich B.C. for electricity mains.

Leeds.—Electricity Extensions.—We have received from Mr. Nelson Hefford, manager of the Corporation electricity undertaking, a report on the further extension of the Whitehall Road generating station. This report has been adopted by the Electricity Committee, and, subject to the approval of the City Council, the first portion of the extensions, embracing a 12,000-kw. turbo-alternator, boilers, auxiliary plant, buildings, &c., will be put in hand, at an estimated cost of £300,000; also the replacement of two 1,400-kw. reciprocating sets by a 6,000-kw. turbine set, at an estimated cost of £35,000. It may be recollected that in 1914 the Corporation adopted a report under which the older works on the Whitehall Road site were to be reconstructed, new engine, boiler, and switch houses, &c., being provided to accommodate 36,000 kw. of generating plant in three 12,000-kw. sets. The first portion, comprising about one-third of this scheme, estimated to cost £198,250, but actually having cost some £25,000 more, will be completed by the end of the year, and the present recommendations deal with the further stages of the work.

The older portion of the works contains at present 26,600 kw. of generating plant and 21,000 kw. of boilers, while the first section of the new works contains 18,000 kw. of generating plant (*i.e.*, a 12,000-kw. set and a 6,000-kw. set installed as a safeguard against breakdown in the older plant) and 12,800 kw. of boiler plant. There will therefore be 44,600 kw. of electrical and 33,800 kw. of boiler plant installed at the end of the year.

On the basis of past experience it is estimated that the maximum demand will reach 28,000 kw. in 1918, and that the plant margin will be 1,800 kw. electrical, with a shortage of 1,500 kw. in boiler plant; in 1919, 31,500 kw. max. load, with margins of 1,500 kw. electrical, 50 kw. boilers; in 1920, 35,000 kw. max. load, with 5,500 kw. electrical and 3,150 kw. boiler margin; and in 1921, 38,500 kw. max. load, with 14,000 kw. margin electrical and 8,450 kw. margin of boiler plant. The total available plant at that date will be 52,500 kw. of electrical and 46,950 kw. of boiler plant. The electrical total includes, in addition to the two 12,000-kw. sets required to complete the 1914 scheme, two 6,000-kw. sets, which it is intended to install in place of the last remaining reciprocating sets (four of 1,400 kw. each).

The report contains some interesting calculations evidently based on the actual conditions existing in the present plant; thus Mr. Hefford estimates that the use of the more efficient 6,000-kw. set for 3,000 hours in place of older turbine plant would result in a saving of £478 per annum in coal, and again the use of the older turbine plant for 500 hours in place of the displaced reciprocating plant, would save another £900 in coal. In addition, the boilers on the new basis would supply 4,282 kw. more plant, equivalent to a saving of £21,410 on new boilers, &c., and £2,141 in annual charges.

It is proposed to utilise surplus profits and reserve in paying off the outstanding debt on reciprocating plant, &c., and allowing for the residual value of this plant and setting the financial charges on the new 6,000-kw. plant against that on the displaced plant, leaves a net increase in annual charges of £1,120, against which the savings (previously mentioned) of £3,519, would result in a net return of £2,399 per annum, or 8½ per cent. on the investment, during an estimated period of eight years. Mr. Hefford points out that this is approximately £1,000 per annum more than would be obtained by investing surplus money outside the business.

Manchester.—The Electricity Committee met specially to consider the reports of the Committee for the Interconnection of the Lancashire and Cheshire Electric Supply Systems, and a resolution was adopted without dissent approving of the principles contained in the reports, and without endorsing all the details at this stage, authorising the chairman, deputy-chairman, and general manager, together with the town clerk, to attend further conferences on the subject.

Rochdale.—The Rochdale Tramways Committee has agreed to a recommendation of the general manager, Mr. George Webster, to close down the present electricity sub-station at Littleborough, and to substitute an additional cable from Smallbridge to Hurstead, at a cost of £450. It is expected that the new arrangement will result in a considerable saving to both the tramways and electricity departments, which will share the cost.

Salford.—Price Increase.—The E.C. recommends a further increase in the charges for electricity of from 10 per cent. to 20 per cent. for lighting, and from 15 per cent. to 30 per cent. for power, as from December 1st.

Linking-up.—The Electricity Committee agrees to the main outlines contained in the second report of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, but considers the details thereof should be referred for consideration to a Committee consisting of representatives of each of the supply authorities concerned.

Southampton.—Price Increase, &c.—The T.C. has decided to increase the charges for electricity by 10 per cent. from the December readings, and to spend £6,300 out of capital account, £2,700 being for a new feeder for the Northam district and £3,590 for a new tramway feeder.

U.S.A.—Electric Cooking.—Data published by the N.E.L.A. shows that during 1916 the Boston Edison Co. sold 1,019 electric ranges, with an estimated rating of 5,225 kw.; more than 1,200 ranges were on circuit this year, or one range per 1,000 of population. A Western city had 1,194 electric ranges installed, or 4·6 per 1,000 of population; in San Francisco it is computed that there is one range per 1,000 of population, and in Ohio 1·3 ranges per 1,000 of population.

TRAMWAY AND RAILWAY NOTES.

Belfast.—The half-yearly return of the revenue of the tramways shows that, allowing for all fixed charges, there was a credit balance of £315, which, under the existing war circumstances, was considered satisfactory.

Continental.—Spain.—Application has lately been made for a concession for the construction and working of an electric tramway in the town of Burgos.

Croydon.—Year's Working.—Presented on Monday, the annual report of the Corporation tramways shows total receipts amounting to £89,585, working expenses £69,713, and war allowances £5,823. After allowing for bank interest and income-tax on stock, there remained a gross balance of £16,297; as £17,930 was required for interest, sinking fund, and taxes, the deficit on the year (ended March 31st) was £1,634, which had been taken from the reserve and renewals fund.

During the year over 19 million passengers were carried, giving a traffic revenue of 10½d. per car-mile; the car-mileage was 2,027,135. The chairman of the Committee (Alderman Allen) foreshadowed great expense after the war in relaying the track and in needed extensions. The 75 cars, he said, had been kept thoroughly in order; many had been entirely rebuilt during the war. To October 19th the traffic receipts showed an increase of £14,236 over the corresponding period of last year.

Dewsbury.—Great inconvenience to working people has been caused by the suspension, owing to shortage of drivers, of the morning car service between Dewsbury and Earlsheaton. The tramway company has assured the Corporation Tramways Committee that every effort is being made to secure additional drivers.

Dover.—B. of T. Report.—Col. J. W. Pringle, reporting on the runaway tramway accident which occurred on August 19th, comes to the conclusion that the driver "lost his head" at the critical moment, the accident being caused by his failure to cut off power as he approached the compulsory stopping place on the summit of Crabble Hill, and his further failure to utilise properly the sand and brake equipment. In the inspector's opinion, the driver's own statement that he was unable to move the controller (small) handle into the emergency brake position, confirms the view that power was applied as the car ran down hill; the inspector found, after the accident, no difficulty in manipulating the controller-handle with the power-handle in the "off" position. Col. Pringle states that men discharged as unfit for military duties on account of nervous breakdown are unlikely to prove suitable, two months later, as drivers on difficult routes; he doubts whether Local or County Appeal Tribunals are aware of the difficulties of finding suitable men, or whether they realise the public risk incurred when insufficiently trained men are employed. He points out that the war has materially reduced safe working conditions on tramways, and recommends that such a route should not be worked unless by men who have had at least a year's experience to their credit; that drivers be familiarised with the rheostatic brake; and that either single-deck cars be used on the route, or no passengers permitted to travel on the upper deck.

The T.C. has decided to levy a 1s. 6d. rate to meet compensation claims arising out of the above accident, which resulted in the death of 11, and injury to 59 other people.

Glasgow.—Wages.—Sheriff Fyfe has issued an interlocutor regarding the wages of certain classes of employés in the tramway department. Generally speaking, the award provides (*a*) for male employés now in the service of the department having their pre-war remuneration increased by 15s. per week (7s. increase of wages and 8s. of war advance), so far as this has not already been done; (*b*) for female employés receiving remuneration, so far as not already given, equivalent to the remuneration set forth in certain orders by the Minister of Munitions. The result is that male employés in the various grades will receive increases varying from 2s. up to 7s. per week; female employés will receive no advance, as they have already 8s. per week more in the tramway service than they would have in a munition factory; the arbiter is of opinion that it is reasonable that male workers should be brought within the principle of the awards of the Committee on Production; and the principle which should be applied to female workers is that expressed in the orders of the Minister of Munitions above referred to.

Leeds.—The lighting restriction on the tramways has been considerably modified recently, with the consent of the Home Office—much to the satisfaction both of passengers and conductors—but some members of the public have shown a tendency to go beyond the intentions of the authorities, and it has been necessary to issue a warning against the removal of any of the shades still remaining on the cars.

London.—The Highways Committee of the L.C.C. recommends that the requests of the men employed at the Greenwich generating station for the application to them of the awards of the Committee on Production relating to the engineering and foundry trades, of leading cable hands, and cable hands, for an increase in wages of 100 per cent. on pre-war rates, and of wiremen and wiremen's mates on the depôt wiring staff for increased war wages, be referred to the Electrical Conciliation Board.

The increase in fares on the Metropolitan Electric Tramways came into force last week, the services affected being Enfield and Euston, North Finchley and Finchley Park, and Bruce Grove and Finsbury Park. One of the longest penny sections in London—Finsbury Park to Wood Green—disappears, the stage now ending at Turnpike Lane, Hornsey.

Manchester.—Traffic Figures.—The total revenue on the Corporation tramways for the half-year ended September 30th was £513,624, compared with £506,558 in the corresponding period last year. The working expenses were £310,325, and, with war service allowances and bonuses, &c., the total expenditure was brought up to £455,011. The total car-miles run were 9,381,230. Expenditure on renewals amounted to £13,000. The recent arbitration awards granting further bonuses will cost the department about £45,000 per annum, which makes the total payable as war bonuses and war service allowances nearly £200,000 per annum.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Automatic telephones have been installed at Cordoba and Rosario, and have given excellent results. An installation is shortly to be set up at Buenos Ayres.

A German submarine telegraph cable scheme hung up by the war is that from Emden to Pernambuco. The scheme was being carried out by a German cable firm of Nordenheim, and two sections from Emden to Teneriffe and from Teneriffe to Monrovia in the Republic of Liberia, were completed in March, 1911; the third and last section—that to Pernambuco—remains uncompleted.

Australia.—The transference of the Eastern Extension Co.'s cables ending at La Perouse, N.S.W., and Wakapuaka, N.Z., respectively to Sydney and Wellington was to have been completed by the end of August, establishing direct communication between Wellington and Sydney, and thus avoiding two repetitions of messages en route.

New Cables.—A concession has been granted to the Western Telegraph Co., whose headquarters are in London, for a cable connecting Rio de Janeiro with the Isle of Ascension and for another cable joining Belem-Para, in the north of Brazil, with Barbados. The construction of these cables will greatly facilitate telegraphic communication between South America and the rest of the world.

Storm Damage.—Considerable damage to property was done by the gale in the West Riding last week, and telephone and telegraph wires were reported to be down in over a hundred places around Leeds and Bradford, communication with distant parts, including London, being considerably interfered with.

Wireless Telegraphy on Board Ship.—The Defence of the Realm Regulation which made compulsory the installation of the wireless telegraph on certain British ships of 3,000 tons and upwards has been amended by the reduction of the tonnage to 1,600.

Wireless Telegraphy on Zeppelins.—According to the *Times*, a French officer, who has examined the Zeppelin that was brought down intact at Bourbonnes les Bains last month, states that the fleet of which it formed a part came to grief partly owing to the breakdown of its wireless apparatus due to the extreme cold at the high altitudes attained. There was also a failure on the part of the wireless stations on land from which the Zeppelins got information as to their position by code messages. Owing to the number of airships which lost their bearings, the land stations got confused, and their answers to questions asked of them were unintelligible.

It is known that, before the war, the Germans established a series of wireless stations near their frontiers, for the purpose of guiding aircraft, but whether this system would be of any practical use in the case of airships moving at a considerable distance outside the ring seems to us very questionable, unless some form of directive receiving apparatus such as the Bellini-Tosi, or some system elaborated since the outbreak of war, has been installed on each airship.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 19th. G.N. of Scotland Railway. Telegraph material for six or twelve months. Stores Superintendent, 80, Guild Street.

Australia.—Perth.—December 5th. Deputy P.M.G. Telegraph and telephone instruments and parts, also battery material, according to schedule and conditions, a copy of which may be seen at the offices of the Electrical Review, or at the Commonwealth Offices, Australia House, W.C.

December 12th. Deputy Postmaster-General. Switchboards, telephone parts, as per schedule, a copy of which, as well as the contract conditions, may be seen at the offices of the Electrical Review, or at the Commonwealth Offices, Australia House, W.C.

Beckenham.—November 12th. U.D.C. Three months' supply of coal for the electricity works. See "Official Notices" to-day.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Telegraph material for 12 months. Mr. J. Duff, Secretary, Enniskillen.

South Africa.—November 12th. S. African Railways. 4,466 train-lighting cells. Secretary, Tender Board, S.A. Railway Headquarters, Johannesburg. Specifications may be seen at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2.

Spain.—The municipal authorities of Soria have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Walsall.—November 5th. Corporation Tramways Dept. Twelve months' tramway stores. Tramways Manager, St. Paul's Buildings, The Bridge.

York.—November 2nd. N.E. Railway. Telegraph stores for six and twelve months. See "Official Notices" Oct. 26th.

CLOSED.

Bradford.—Electricity Committee. Portable wagon and truck loader for handling stock coal at Valley Road power station: Goodall, Clayton & Co., Ltd., Leeds. 12,000-kw. turbo-generator, £45,775: Parsons & Co., Ltd.; the Committee has authority to order a condenser for same.

East Ham.—Town Council. Accepted tender:—

Edison Accumulators, Ltd.—Six electrically-propelled dust-vans, at £1,121 each, and one automatic electric filler, at £2 10s.

Ilford.—U.D.C. Accepted tenders:—

General Electric Co., Ltd.—D.C. switchboard for sub-station, £296; E.H.T. switchgear, £174; additional equipment for switchboard, £74.
Herbert Morris, Ltd.—7½-ton overhead travelling crane and rails, £106.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, November 3rd. At 7 p.m. At the Royal Technical Institute, Peel Park. Members' short papers for gold medal given by Mr. W. O. Larmuth.

Chief Technical Assistants' Association.—Saturday, November 3rd. At 3 p.m. At the Tavistock Hotel, London. Ordinary meeting.

Roentgen Society.—Tuesday, November 6th. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Presidential address.

Institution of Civil Engineers.—Tuesday, November 6th. At 5.30 p.m. At Great George Street, Westminster, S.W. Presidential address and presentation of medals.

Faraday Society.—Wednesday, November 7th. At 5.30 and 8.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W. Discussion on "Pyrometers and Pyrometry."

Institution of Electrical Engineers.—Thursday, November 8th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Inaugural address by the president, Mr. C. H. Wordingham, and presentation of premiums.

NOTES.

Volunteer Notes.—County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. P. Bowden.
Next for Duty.—Second Lieut. E. A. Ullmann.
Drills.—Week ending Saturday, November 10th, 1917:—
Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
Tuesday.—Physical drill and bayonet exercise, 7.30.
Wednesday.—No. 1 Company, 6.30.
Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Saturday.—Commandant's Parade for Route March and Drill. Parade Headquarters, 2.45. Uniform. Compulsory for A, B, and C men.
Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.
Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.
An Inspection of all A, B, and C men has been arranged for Saturday, November 17th. Full particulars in next week's orders.
(By order) Macleod Yearsley, *Capt. and Adjutant.*

Employers' Organisation.—The *Daily Chronicle* states that an agreement which has just been reached between some of the larger Employers' Associations will shortly crystallise into a permanent organisation with large powers. The Associations which have already signified general approval of the scheme include the National Employers' Federation, the Engineering and Shipbuilding Federations, the Federation of British Industries, and the Sheet Metal Workers. The root idea is to establish a central authority which will constantly review the conditions of work and wages without an extension of the principle of State intervention, and will have the power to make agreements with the labour organisation for whole areas and whole industries.

Dangerous Mischief.—At the Saddleworth Police Court, last week, a 16-year old boy named James Whitehead, who was stated to be earning 30s. per week, was ordered to pay £1 damage and 15s. 6d. fine for fusing an electric fitting at the Gatehead Mill, Delph, where he was employed. After inciting another lad to mischief, the defendant applied a bit of wire to an electric light fitting, protecting himself from shock by using woollen waste. The result was the fusing of the wire, a burst of flame, and the extinction of many lights. There was danger both of the destruction of the mill by fire and of injury or loss of life by the panic which might have resulted from the sudden darkness. The proceedings were taken as a warning, there having been a succession of these mischievous acts. The shed was a new one, costing £20,000, and the firm had had a destructive fire in 1915, which might have originated in some such way.

Educational.—Blackpool.—The Education Committee has refused to accede to a request to commence classes in Blackpool on electrical subjects, though it was stated that a satisfactory number of students would be forthcoming. In explaining the refusal, the chairman of the Higher Education Committee stated, on Tuesday, that if the class was held there would have to be other classes in physics and practical mathematics, and provision would have to be made for a suitable amount of machinery and apparatus. In view of the expense and the probable small number of students, the Committee did not think the present was an opportune time to start such classes. Commenting on this decision, a local contemporary remarks:—"Surely this is not the new spirit which is going to do such great things educationally in England."

Bristol University.—Mr. Henry H. Wills has presented to the University of Bristol, property covering nine acres adjoining the present site of the university buildings, for future extensions.

Electric Lamp Stealing from Trains.—A 14-year old boy, of Ashton-on-Mersey, was fined 45s. at the Manchester County Police Court, on Monday, for wilfully removing and breaking an electric bulb in a third-class compartment on the Manchester, South Junction and Altrincham Railway, whilst passing through a tunnel at Old Trafford. An inspector of the Great Central Railway police stated that 500 lamps had been stolen from railway carriages during the last six months, and 70 bulbs that had been missed had not been replaced, on account of shortage.

Industrial Combination.—The speeches which were delivered by Mr. Paish and Mr. C. Hamilton Wickes before the Birmingham Brass Masters, urging them to co-operate and combine in readiness for after the war, have been followed by another along the same lines but in greater detail delivered in the same city by Sir W. Ashley. In this case the audience consisted of the Federation of British Industries and the National Union of Manufacturers. Sir W. Ashley showed that it was in the national interest that there should be far more combination between manufacturers within the several trades. In the past combinations had broken down because their object had been to maintain prices without effecting economies in production. This put a premium on unprogressive equipment and incompetent management. The combination that would be approved by the public, and would extend its hold upon the world's markets, would be one which combined a reasonable profit to the manufacturers with reasonable cheapness to the consumer. Under modern conditions these ends could only be achieved by the introduction of specialisation rendering possible the continuous employment for each process of the most suitable machinery. Each trade must settle for itself how this should be carried out. The necessity, however, must be recognised, and it must also be seen that the carrying out of the principle of combination involved some amount of restraint on the present freedom of business concerns. Referring to unemployment questions, he stated that the root cause of the instability of employment was the inability of uncombined manufacturers to stabilise production. There was still far too wide a range of manufacture where a single obstinate concern was able to upset or disregard a trade agreement to which the great bulk of the industry concerned had consented. Out-of-date individualism caused social mischief. If the manufacturers in a trade could not manage to make wage agreements binding on competing concerns, the State would have to enforce such agreements. In regard to the question of industrial training, every trade ought to be able to provide for itself the amount of skilled labour that it required. This could be done by concerted action. The difficulties of industrial reconstruction called for a sufficient knowledge of facts and statistics, in order that they might be properly handled. Where employers and employed were properly organised, and through properly organised trade combinations, such material could be easily obtained.

Inquiries.—A correspondent wants a vacuum oven to take armatures up to 3 ft. 6 in. in diameter, or suggestions as to the cheap construction of one. Makers of the "Elco" recorder are asked for.

Appointments Vacant.—Mains superintendent, also meter tester and erector, for the Kettering U.D.C. electricity works. Newport Corporation wants an installation inspector, a mains foreman, E.H.T. jointers, and wiremen. See our advertisement pages to-day.

Reconstruction.—The November issue of the *World's Work* contains a lengthy article on the "Reconstruction of Prosperity," by Dr. G. B. Hunter, chairman of Messrs. Swan, Hunter & Wigham Richardson. The writer describes, in a most interesting way, the steps that, in his opinion, are necessary for the reparation of the wastage of war and the restoration of our commercial prosperity.

British Standards for Electrical Machinery.—We have received from the British Engineering Standards Committee a copy of the new edition of the "British Standardisation Rules for Electrical Machinery (excluding Motors for Traction Purposes)," being Report No. 72—1917 of the Committee. The first issue of this Report was made in October, 1915, and special attention is directed to the new form in which these rules appear. In line with all new and revised Specifications and Reports issued by the British Engineering Standards Committee, this publication is octavo size, and is issued at the uniform price of 1s. net. French, Italian, and Spanish translations of this Report will be available shortly. The Committee is particularly anxious that the issue of its publications at the flat rate of 1s. should become as widely known as possible, for it is hoped that this will lead to their very extensive dissemination amongst engineers, managers, designers, draughtsmen, foremen, and, in fact, all those engaged in the engineering and allied industries. The principal modifications introduced during this revision of the rules are as follows:—

The permission to use the thermometer method of measuring the observable temperature of continuous-current shunt-wound stationary field coils, provided the maker can show that if the resistance method had been employed the limits of observable temperature and observable temperature rise permitted by the rules would not have been exceeded. (Clause 68.) The thermometer method is in this case penalised with a 5° C. reduction in the permissible temperature limits. (Clause 67.)

In the first edition of these rules the use of embedded temperature detectors was permitted for large machines, but in the present rules measurements made with embedded temperature detectors are no longer to be considered as an essential part of the acceptance tests.

The excess-current tests have been reduced in the case of machines for continuous service from 100 per cent. to 50 per cent. (Clause 79).

A few alterations have been made to the high-pressure tests, and a clause has been added dealing with the application of a high-pressure test to a machine which has been out of service for some time and to which it is desired to apply a high-pressure test to ensure that the insulation should be in sound working condition before the machine is put back into service. In this case it is stated that the test pressure should be 75 per cent. of the test pressure required in the case of a new machine.

The rules have been re-arranged, and an introduction, the object of which is to explain briefly how the rules should be used, has been included.

Wages of Electrical Wiremen.—The General Purposes Committee of the L.C.C. recommends that the Council's list of wages and hours be amended by the addition of the following:—"That from and including July 1st, 1917, the agreed rate for wiremen in the electrical trade has been advanced to 1s. 2d. an hour and for assistants to 11d. an hour."

Electrical Instruction at Barcelona University.—Under the title Instituto de Industrias Electricas, a school of electrical engineering has lately been established in Barcelona, in connection with the University of that city.

Society for Electrical Development (U.S.A.).—There will be no national "electrical week" celebration this year, owing to war conditions; it has been decided to hold it next year, and there is a strong feeling in favour of the time being changed from the autumn to the spring season. A special electrical campaign, however, will be conducted in the form of "a big drive for Christmas appliance business," the idea being to encourage the purchase of electrical appliances for Christmas presents.

Stolen Club Funds.—At the Manchester County Police Court, on Monday, Albert Robertson Stark (42) was sent to prison for six months, with hard labour, for stealing the sum of £234 5s. 6d. in July last. It was stated that the prisoner was employed at the Lancashire Dynamo & Motor Co.'s works, Trafford Park, Manchester, as a costs clerk, and he had acted as treasurer of the works' holiday saving club, which was carried on by the employés. When the books were examined on August 3rd, it was found that there was a deficiency of £108, but later it was found to reach the figure mentioned above. At that time the man was missing, and he was arrested on Saturday night through an employé from the works visiting a suburban theatre and recognising the prisoner, who was performing under an assumed name, by his voice.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the October meeting, after the election of a further list of members, a proposed amendment of the Standard Policy of Insurance of Diesel Engines against Breakdown was considered, and arrangements were made under which differences arising between the underwriters and the policy holders as to the interpretation of the policy may be submitted for decision to a special committee appointed by the Association.

The president, Mr. Geoffrey Porter, reported on the position in regard to the supply of tar oils as Diesel engine fuel to members of the Association, as discussed with the Director of Munitions Petroleum Supplies. In the discussion which followed, the difficulty of making satisfactory arrangements for continuous supplies of fuel for the short periods allowed for by the licences issued by the Director of Munitions Petroleum Supplies was referred to. Attention was drawn to the point that the action of the Association in encouraging the use of tar oils as fuel in Diesel engines should be of advantage in the national interest in stimulating the economical use of the country's coal reserves and in permitting of the extraction of valuable products from the coal, several of which are of especial importance to the country in present circumstances. As an example, the Hon. Secretary produced the figures of the Diesel engine plant at Chelsea, in which case the consumption of 700 tons of fuel oil per annum resulted in the replacement of a total weight of 6,000 tons of coal per annum which would otherwise have had to be transported by the railways, and which would have produced about 500 tons of clinker and ashes for which cartage facilities would have had to be provided.

Mr. H. S. Russell read a paper on "Automatic Control of Blast Pressure for Diesel Engines," in which he described the construction and working of Messrs. Mirrlees, Bickerton & Day's apparatus for regulating the blast. Among the advantages claimed for the apparatus are smoother running of the engine, saving in fuel, less attendance on the engine, improvement in the condition of exhaust valves, and the replacement of the blast bottle by a small separator.

Textile Congress.—At the annual meeting of the Textile Institute recently held at Preston, a paper was read by Dr. J. F. Crowley on "Science as a Factor in the Development of the Textile Industry," in the course of which he pointed out the need for co-ordination between the textile machinist and the power engineer. Much of the present-day machinery was designed when main line shafting speeds were 40 R.P.M. or less, and though such speeds have considerably increased they are still below the most suitable from the electrical point of view. Individual electric driving has been the most significant advance in textile machine driving of recent years, but the best results can only be obtained if modifications are made in the driven machines, and such modifications can only be made if the textile machinist and power engineer act in close co-operation.

As showing in a broad way the possibilities in the application of electricity to the industry, it may be noted that only 5 per cent. of the power required by textile factories in this country is obtained from electricity generated in the factories themselves and only one-half of 1 per cent. from electricity purchased from outside supply undertakings, and this although the textile industries furnish nearly one-fifth of the total power load of the United Kingdom.

On the question of labour, Dr. Crowley says it is easy to show that a high net output per operative and a high horse-power per operative are invariably associated with high wages. Statistics for the cotton trade in 1833 and the Census of Production (1917) give the following figures :—

	1833.	1907.
H.P. per operative	·09	2·16
Net output per operative per annum ...	£47·5	£79
Wages per operative per annum ...	£21·4	48

In the period under review, nearly three-quarters of a century, the H.P. per operative has increased 24 times, and the net output of the individual by 66 per cent., while wages have increased by 124 per cent.

As regards the question of research work, Dr. Crowley contends that "industrial" research has been much neglected.

The necessity for developing industrial research, made apparent when war broke out, led to the formation of an Advisory Council on Research on which, however, all the members but one are fellows of the Royal Society—membership of which is the blue ribbon of the pure scientist; the sole exception is referred to as the "administrative chairman." Dr. Crowley considers that it was evidently the intention of the Privy Council that this Council should consist not only of eminent scientific men but also of men actually engaged in industries dependent upon scientific research.

Every step taken by the Council for Research thus far seems to indicate the intention of maintaining an over-riding position for the pure scientist, and the standing committees already formed show what a large percentage of these bodies is nominated by a largely academic Council.

Reputations in pure science are frequently built up in extremely limited spheres of work, and the whole atmosphere of academic work is fatal to that broad outlook and grasp of the tendency of industrial development so essential in deciding on types of research to encourage.

Institution of Electrical Engineers.—The first meeting of the Institution for the session is to be held on Thursday next at 6 o'clock (light refreshments at 5.30 p.m.), when Mr. Wordingham will deliver his presidential address. Other arrangements for the session are as follows :—

November 22nd.—"Gas Firing Boilers," by Mr. T. M. Hunter.
December 6th.—"Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Gillott.
December 13th.—Discussion on "The Metric System," with introductory papers by Messrs. L. B. Atkinson and A. J. Stubbs.
January 10th, 1918.—"Electrical Signalling and Control on Railways," by Mr. C. M. Jacobs.
Subjects for February 7th, March 7th, and April 11th will be announced later.

The inaugural address of the chairman of the Birmingham Local Section (Mr. S. T. Allen) is to be delivered on Wednesday, November 14th, at 7 p.m., at the University. On December 5th, Mr. T. M. Hunter, M.A., B.Sc., will read a paper on "Gas-Firing Boilers."

Association of Mining Electrical Engineers.—A meeting of the Yorkshire Branch was held at Wakefield on Saturday last. Mr. Roslyn Holiday, of Ackton Hall Collieries, occupied the chair, and delivered his presidential address. A paper on "The Installation and Maintenance of Underground Plant" was then read and discussed.

British Fire Prevention Committee.—The Committee commenced its winter session during October, and has planned a number of testing operations for the coming spring, and the usual issue of its publications during the winter. It has issued some of its usual Red Books on recent American fires, but some of the reports of the Committee on fire preventive questions that were prepared earlier in the year for the use of the authorities cannot be made available to the public during the war.

The Committee's service of fire "warnings" continues to be extended, and there have been numerous re-issues during the past quarter. New issues of notices have also been made in respect of storage of coal in bulk and the treatment of burns under an up-to-date non-proprietary system.

Electricity in Agriculture.—In the report of the Conjoint Board of Scientific Societies, just issued, it is stated that the Sub-Committee on the Application of Science to Agriculture emphatically believes that a great future awaits the development of electrical applications to agriculture in this country. Reference is made to the probable action of the Board of Trade Committee on Electric Power Supply in the direction of rendering cheap power available in agricultural districts, and to the extended use of electricity on farms in Germany; the advantages of electric ploughing are emphasised, and electroculture receives a favourable notice. It is added that on October 10th the Conjoint Board recommended the Board of Agriculture to grant funds for the construction and testing of an electrical tractor and other agricultural machines. Owing to the late arrival of the Report, we must defer detailed reference to its contents till next week.

Association of Electrical Station Engineers.—A meeting was held in Manchester, on October 25th, to continue the efforts of the Local Committee of the A.E.S.E. to obtain further support for this Section of the Association. The Committee reported that the membership was increasing rapidly. The following resolution was approved :—"That each application for admission to the Association should be considered on its merits, special emphasis being laid on the necessity of training, general capabilities, and responsibility of position." A vote of thanks was unanimously accorded to the Editors of the Electrical Review for their sustained support of electrical station engineers in their efforts to improve their status. A special general meeting is to be held at Seller's Restaurant, 86A, Market Street, Manchester, at 7.30 p.m., on Thursday, November 8th, to discuss the question of the awards of the Committee on Production and their applicability to station engineers, and it is hoped that all station engineers interested will attend. Inquiries concerning this Section of the Association should be addressed to the Hon. Secretary A.E.S.E., 15, Lotherton Street, Harpurhey, Manchester.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The L.C.C. Highways Committee recommends that Mr. H. R. Docker, second-class assistant in the Council's tramways department, be appointed time-tables assistant at £262 per annum, rising to £300, and that Mr. H. W. Woods, A.M.I.E.E., at present senior charge engineer in the service of the Manchester Corporation, be appointed a charge shift engineer at Greenwich generating station at £250 per annum, rising to £300. The Committee considers that the present time is not opportune

for making a permanent appointment of a publicity assistant for the tramways, and proposes that, as a temporary measure, a woman be engaged to assist in publicity work.

The Luton E.C., which for some time past has been considering the question of revising the salary of Mr. W. H. Cooke, the electrical engineer, now suggests an increase from £600 to £700 a year.

Mr. Henry Clayton has been appointed assistant engineer and manager of the Preston Corporation tramways, at a salary of £200 per annum. He has been in the service of the Corporation for about 12 years.

Heston and Isleworth D.C. has agreed to Mr. P. Rycroft, its electrical engineer, devoting his full time to his duties in the Coal Control Office, and giving his honorary supervision to the Council's electricity department when required.

Mr. W. A. Toppin, testing and commercial assistant at Greenock Municipal electricity works, has been appointed assistant electrical engineer under the Chesterfield Corporation at £250 per annum.

The Doncaster Town Council last week accepted the Electricity and Tramway Committee's recommendation granting Mr. G. A. Roberts, acting electrical engineer, and Mr. T. Potts, acting traffic manager of the tramways, an increase of £50 per annum each on their salaries, during the absence of Mr. Rayner, the chief engineer, on Government service.

The Blackpool Tramways and Electricity Committee has decided to grant the following salary increases to officials in those departments:—Electricity Staff: Works superintendent, £250 to £300; mains superintendent, £234 to £284; chief clerk, £175 to £225; two engineers-in-charge, £175 to £215 each. Tramways Department: Traffic superintendent, £250 to £300; resident engineer, £234 to £284; chief clerk, £156 to £206. No war bonuses are to be granted in addition.

Congratulations to Mr. R. Torpy, borough electrical engineer of Tunbridge Wells, who has been presented with a Royal Humane certificate for entering the sea fully dressed and rescuing a bather. The presentation was made by the Mayor of Eastbourne.

General.—Major Henry Newton, D.S.O., a member of the firm of Newton Brothers (Derby), Ltd., electrical engineers, has been appointed Assistant Director of Trench Warfare. He went out to France as a Territorial Captain in the 5th Notts. and Derby. Battalion, which was mobilised at the outbreak of war, early in 1915. His experience of actual trench warfare soon supplied the necessary material for his inventive talent Many useful and efficient devices were the outcome of his labours for the destruction of the enemy and the greater comfort of our own men, which in those lean days of want were very much appreciated. He then founded the Second Army workshops, which became well known to those in France, where a large number of hands are employed in the manufacture of his inventions and other war material. His services were recognised with the award of the D.S.O., and he was later appointed a member of the Trench Warfare Committee. His hard work and ability have led to this new appointment, and he has earned the congratulations of his many friends.

Mr. A. W. Janes, the assistant works manager and a keen supporter of the Sterling Athletic and Social Club, has presented a handsome cup for a rifle shooting competition, for which in the first round, as well as for the gold medal presented by Mr. F. W. Wilkinson, there has been some very keen shooting. The Club, by a narrow victory over Hendon and Cricklewood, has passed into the second round of the Burroughs & Watts Competition.

Mr. Walton, who for the past eight years has been on the engineering staff of W. T. Henley's Telegraph Works Co., Ltd., has obtained a position with the Ministry of Munitions (Air Board). Mr. Walton belongs to the old school of electrical engineers, and has been connected with electrical work almost from its infancy. He served his apprenticeship at the works of John Fowler & Co., Leeds, going through the drawing office and the shops. The Leeds electric lighting station was the first undertaking with which he was connected. He has contributed several articles to our pages.

Roll of Honour.—Second-Lieutenant H. F. Gill, R.E., Wireless Section, of the secretarial department, County of London Electric Supply Co., who had been awarded the Military Medal in 1916, has recently been wounded in France, and is at present convalescent in London, and has now been awarded the Military Cross.

Corporal G. Wheldon, London Regiment, formerly in the London office of the India-Rubber Co., was killed in France on October 1st. Sergeant N. G. Fairall, Australian Infantry, who was in the electric light department before joining the Sydney branch of the same company, was wounded in France on the 12th inst. Private J. Browning, Middlesex Regiment, formerly in the general office of the company at Silvertown, was recently wounded in France.

Gunner A. Homer, R.F.A., who has died of wounds, was in the employ of the British Westinghouse Co., Ltd., Trafford Park.

The death in action is reported of Private T. Cook, King's (Liverpool) Regiment, who was employed by Messrs. Dick, Kerr & Co., Ltd., of Preston.

Sapper E. Clarke, R.E., who was mentioned in dispatches from Lieut.-General Sir Stanley Maude for gallant and distinguished service in the field, and who has died in hospital, was employed in the Warrington Corporation electricity department.

Temp. Captain E. Mannock, R.E., attached to the R.F.C., who has been awarded a bar to the Military Cross gained last September, was formerly on the National Telephone Co.'s staff at Canterbury. On the outbreak of war he was in Constantinople, engaged on a contract for telephones for the Turkish Government. He was detained for a time as a prisoner of war, but was released, and reaching England joined the R.A.M.C.

Lance-Corporal W. Banning, Machine Gun Section, who has been wounded, was an overhead linesman on the Mexborough & Swinton Tramways.

Second-Lieutenant C. H. Platt, Royal Warwickshire Regiment, who has been severely wounded, was a draughtsman with Messrs. Siemens Bros., Stafford.

Private W. W. Holey, Royal Warwickshire Regiment, who has been killed whilst attending the wounded, was in civil life engaged as an electrical engineer at Whitby.

Corporal E. P. Moore, Machine Gun Section, who has died of wounds, enlisted from the electrical laboratory of the B.T.H. Co., at Rugby.

Rifleman B. C. Lane, Rifle Brigade, who has died as the result of wounds received in action, was in the drawing office of the B.T.H. Co. at Rugby. He was discharged from the Army last April.

Company-Sergeant-Major G. H. Hayes, Royal Warwickshire Regiment, who was an employé of the B.T.H. Co., at Rugby, has died of wounds received in action.

Wireless Operator F. J. Stiby, killed whilst serving with a siege battery, enlisted from the staff of the Bath Corporation electricity works.

Private C. W. Edwards, Royal Welsh Fusiliers, killed in action, was on the staff of Messrs. Crispin, electrical engineers, of Bristol.

Private J. Bain, R.A.M.C., who has died from wounds, aged 33, was a fireman at the Falkirk Corporation electric power station.

Sergeant A. Harisreicter, first reported missing, and now reported killed, was employed by Messrs. C. Macintosh and Co., Ltd.

Private J. Burns, Argyll and Sutherland Highlanders, who was employed by the Scottish Electric Power Co., Falkirk, is lying in a London hospital wounded.

Second-Lieutenant K. L. James, who fell in May last, and is believed killed, aged 29, took a first-class in electrical engineering at the City and Guilds Technical College. When war broke out, says the *Times*, he was superintending the laying of an underground telephone cable for Callender's Cable, &c., Co.

The Military Medal has been awarded to Rifleman T. Barnett, London Regiment, for carrying ammunition to the front line through a heavy barrage during advance at Ypres. Private A. W. Morris, Maching Gun Corps, has been wounded in France. Both were in the electric light department of the India-Rubber Co., Silvertown.

Private J. E. Ashton (21), Royal Warwickshire Regiment, formerly in the employ of the Electric & Ordnance Works, Birmingham, has been killed in action.

Private F. G. Wharton (21), Worcester Regiment, has fallen in action. He was an employé of the General Electric Co., Ltd., at Witton.

Lieutenant R. B. Mathewson, R.F.C., who was an electrical engineer with the Dundee Corporation, and was a grandson of the late ex-Provost Brownlee, of Dundee, is reported missing.

Acting-Major G. S. Taylor, R.E., who was chief assistant electrical superintendent of the N.E. Rly. Co., has been awarded the Military Cross.

Gunner G. H. Wilson, formerly a driver on the Leeds City Tramways, who has been killed in action, has been awarded the Military Medal.

Second-Lieutenant L. Fleet, R.F.C., who was formerly an electrical engineer in Manchester, was killed on Saturday last at Doncaster, a mishap to his machine causing it to crash to the ground.

Obituary.—Mr. W. K. D'Oyley Bignell.—The *Morning Post* records the death, on Friday last, of Mr. William Kyd D'Oyley Bignell, of the Indian Telegraph Department, in his 78th year. Mr. Bignell was appointed to the department in 1857, and 11 years later became Superintendent at Nagpur. He subsequently served in the Punjab, and arranged telegraphs during the Hazara Expedition in 1888, and became Chief Superintendent in 1892, retiring three years later.

CITY NOTES.

Dick, Kerr and Co., Ltd.

The annual meeting was held on Wednesday, at the Cannon Street Hotel Mr. Claud T. Cayley, who presided, said that, comparing the present balance-sheet with that presented a year ago, the net profit showed an appreciable increase. The figures, taken in conjunction with the

totals of assets and liabilities, indicated the magnitude of the company's operations, although they would quite understand that under present circumstances they were unable to publish details. The total of the assets shown in the balance sheet was £2,198,688, as compared with £1,753,410 last year. The increase in the investments was the result of the acquisition of the shares in the United Electric Car Co., Ltd. The capital expenditure at the works showed a decrease on last year's figure, due to their policy of writing off what they considered ample depreciation against this item. Nobody could forecast what post-war conditions would be in the business world, and it therefore seemed essential to avoid the least possibility of inflation of their capital assets. The liabilities side of the sheet showed one particularly important variation from last year's figures, namely, the increase under the heading of creditors and estimated liabilities. This figure was £953,596, which was a large advance upon last year, although the increase was, of course, set off by the increases on the asset side of the balance sheet. The reason for this increase in creditors was that it included the reserve they had set aside for the Excess Profits Duty, as, although their liability under that heading had not yet been definitely settled, it was very obviously necessary for them to reserve what they considered a sufficient sum to meet this charge. The Government continued to be their principal customer, with continuously increasing demands both in quantity and variety. He wished he was allowed to tell them in detail of the ramifications of manufacture and construction which had been undertaken and successfully completed by the company, and still more would he like to tell them of what was being done now, and about to be done in the immediate future. Suffice it to say that all the Departments for which they were working showed their appreciation and confidence in a very practical way, by entrusting them with important work to the limit of their capabilities. The national factory erected under their auspices had been handed over to the Government, and they had now in hand the erection of two more factories for another purpose, and these, together with the construction of important works in different parts of the country, on which they had been occupied for some time, kept the contracting department very busy, and their staff of trained engineers fully occupied. In regard to the controlling interest which had been acquired in the United Electric Car Co., Ltd., the board already felt that transaction to be fully justified, so much so that steps had been taken to extend the shops to cope with work of great importance. The United Electric Car Co. were next-door-neighbours of theirs at Preston, the works occupying an area of some 15 acres, and they made a speciality of tramway car-building. The directors were satisfied that after the war there would be no difficulty in keeping them fully occupied upon profitable work, and, in the meantime, they were serving the national interests. Last year they reported the acquisition of control in Messrs. Willans & Robinson, Ltd. The position had now been consolidated by the acquiring of 86 per cent. of the preferred "B" stock of that company, which had certain participating rights. This transaction was carried through partly by payment in cash and partly by exchange of shares. As it did not take place until after the close of the year under review, it was not reflected in the balance sheet. Steps were now being taken to consolidate the organisations of the two companies, and considerable economy was to be expected both in selling and production. Considerable interest had been shown in the contracting world and among the legal profession in the now somewhat celebrated case of the Metropolitan Water Board *v.* Dick, Kerr & Co. This was still *sub judice*, as, although it was argued last week in the House of Lords, judgment had not yet been given. He had given them the position as they saw it at present, and he thought it might be taken for granted that their organisation and works would be fully occupied during the continuance of the war period. Last year, and the year before, he indicated the likelihood of their having to face a period of uncertainty during the transition from war conditions to normal conditions of peace, whatever the world had in store for them in that direction. The directors and management committee fully realised this, and, therefore, in spite of the abnormal amount of work thrown upon their shoulders, particularly the latter gentlemen, they were doing what they could towards organising for the future, so as to make this transition period as short as possible. He thought they might safely assume that the immediate demand for the product of their different manufacturing works, and also of their engineering contracting organisation, would be very great, and it behoved the management to see that they were in a position to step into the breach without delay. Like all large employers, naturally they were following the attitude of Labour itself, and fully realised that to meet the necessities of after-the-war conditions a complete understanding and co-operation between Capital and Labour was both desirable and necessary. The directors and the management committee had confidence that all would be well in this direction provided Labour was met in a spirit recognising that an entirely new basis of relationship must be established. Given the country and the Empire met the new conditions that were bound to arise after the war fairly and squarely by adopting new methods of Empire and international commercial relationship, he thought the internal relationship of employer and employed could safely be left to the common sense of those directly concerned.

Mr. R. H. Prestwich seconded the motion, and the report was adopted without discussion.

International Light and Power Co.

The net profit, after payment of debenture interest, London and Canadian administration expenses, and interest on loan, and setting aside £2,500 as a special reserve, amounts to £10,331, plus £6,744 brought forward, which is to be carried forward. Further cash advances were made to subsidiary companies on account of capital expenditure, amounting to £19,400. The directors regret that on account of the position of the Mexican undertaking, and the necessity for increasing the advances to subsidiary companies out of earnings, it has not been possible since October 1st, 1915, to pay a dividend on the cumulative preference shares. If, however, the present improvement in Mexico is maintained the directors hope that during the current year they will be in a position to resume payment of dividends on these shares. The subsidiary companies operating in Venezuela and the Argentine have placed to reserves for renewal and general purposes £7,123. Including the reserve of the Mexican company, which has not been added to, the total reserves of the three subsidiaries now reach £39,442.—*Financier*.

Eastern Telegraph Co., Ltd.

Sir J. Wolfe Barry presided at the meeting held on October 24th. He said that owing to delays due to the war they had not been able to submit their accounts at the usual time. The net result of the year's working was remarkable, the gross revenue for 1916 being nearly £415,000 in excess of that for 1915. The expenses showed an increase of about £201,000. The actual profit was better than for 1915 by £213,400. Notwithstanding heavy duties and large increase in expenditure, they had been able to put £500,000 to the general reserve, to pay 8 per cent. free of tax, and to carry forward £28,000 more than for 1915. The company now held on account of the general reserve fund £1,700,000 of the 5 per cent. War Loan Stock. The total amount of that stock held by this and the other associated companies in Electra House was about £6,000,000. At the last meeting he stated that the principal factors that had caused an increase in the number of words carried were the interruption of the Indo-European Telegraph Co.'s line to India, and also the reduction in the carrying capacity for commercial work of the Great Northern Co.'s route to China and Japan on account of the Government requirements; but the further increase over last year was no doubt to a large extent due to the increasing uncertainty of postal correspondence throughout the Empire, which had caused merchants and others to rely more than ever upon the more certain medium of cable communication.

Eastern Extension, &c., Telegraph Co., Ltd.

At the annual meeting, on October 23rd, Sir J. Wolfe Barry, who presided, referred to the reasons for the delay in submitting the annual accounts. The gross receipts for 1916 amounted to £1,221,000, an increase of £271,000, which was due to development of traffic all over the company's system, including the important local traffic between India and China, Japan, Straits Settlements, &c. Working and other expenses increased by £44,000. The net revenue was increased by £227,000. The agreement entered into by the French Government with the company in 1884 for providing and maintaining, under a subsidy arrangement, cable communication between the French possessions of Cochin China and Tonquin had expired, and the cable had been sold and formally transferred to the French Government. After crediting capital expenditure with the cost of that cable (£121,454), which was originally debited to that account, the loss resulting from the transaction, amounting to £66,153, had been debited to the general reserve fund. Under arrangements made with the Governments of the Australian Commonwealth and New Zealand, the company's cable stations at La Perouse (near Sydney) and Wakapuaka (near Nelson) had been closed, and its cables between Australia and New Zealand extended to Wellington, where they were now being worked direct with Sydney under greatly improved conditions. The cost of the extensions and partial renewals of these cables would be debited to the general reserve fund in the accounts for 1917.

Drake and Gorham, Ltd.

The directors report that after payment of all charges, including staff bonuses, &c., and making provision for contingencies, the net profit for the year ended June, 1917, is £11,395, plus £2,150 brought forward. A dividend of 5 per cent. for the year absorbs £6,250, £5,000 is applied to writing down goodwill, and £2,296 is carried forward. The trading profits have increased by £2,868, an improvement of 30 per cent. on the previous year's figures. Contracts have been completed for the Admiralty, War Office, Ministry of Munitions, and other Government Departments, and a considerable amount of similar work is in hand. Both the wholesale trading department and the works show improved results, and the sale of self-propelled electric vehicles has grown rapidly. Arrangements have been completed for the leasing of a larger warehouse, as well as works with greater manufacturing facilities. The directors have voted the further £854 to which they are entitled under the Articles as a war bonus to the office staff.

Credenda Conduits Co., Ltd.—The directors are unable to present the accounts for the year to April 30th. They are satisfied that the interim dividend paid on July 25th last has been earned, but it is not their intention to recommend any further distribution for the year.

Hurst, Nelson & Co., Ltd.—The gross profits for the year to July 14th were £78,770, against £78,426. Dividend at the rate of 10 per cent., and a bonus at the rate of 2½ per cent., free of tax, the same as a year ago.—*Times.*

Russia.—The Electrical Power Co. (capital 9,000,000 roubles) made a profit of 2,036,781 roubles in 1916, against 2,290,590 roubles in the preceding year, and it has paid 780,000 roubles in dividend, the same as for 1915.

The Synchronous Transmission Co. has been formed. Capital: 100,000 roubles.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend of 7 per cent. per annum (3s. 6d. per share), less income-tax, on ordinary shares for half-year.

Victoria Falls & Transvaal Power Co.—The net earnings for the quarter ended June 30th were £224,978, before providing for taxation in South Africa and the United Kingdom.

Anderston Foundry Co., Ltd.—Interim dividend, 4s. 6d. per share, less income-tax.

Westinghouse Brake Co.—Interim dividend of 5 per cent., less income-tax, on ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

NEWS from the Italian front led to a weakening of Stock Exchange prices at the first part of the week, and the disappointment felt with the prospect of the war's being protracted as the consequence of our Allies' reverse was responsible for a generally subdued tone throughout the stock markets. It cannot be said to have acquired any influence over electrical issues, but the mere fact of business having been checked was sufficient to colour the tone drab. Sentiment began to recover on Tuesday, though the volume of buying is perceptibly less, and markets go cautiously in all departments.

With the publicly-announced entry of Brazil into the war, there has been a little selling of Brazilian stocks, Government, railway, and industrial. Why this should be is something of a puzzle, but the fact remains, and Brazil Tractions further weakened to 44. Argentine industrials are also out of favour, thanks to a series of very poor results from the principal railway lines of the Republic. Anglo-Argentine Trams are not quotably lower, but the market is not a good one. Much the same description applies to Mexicans, though here, again, there are no movements to record.

Charing Cross ordinary shares are ¼ better at 4, and South Londons keep a very firm spot at their advanced price of 3. Edison Swans are being bought again, the fully-paid rising to 2½, the others to 26s., and the 4 per cent. debenture stock to 74½. Callenders recovered their dividend of 5s. per share, the price being left unchanged at 14½ xd. British Westinghouse debenture is up a point to 69. Aron Meters, after having been dormant for many moons, nearly doubled in price to-day (Tuesday). The ordinary, from being eighteenpence, rose to half-a-crown, while the preference improved from 4s. 6d. to 7s., with hardly any shares offering of either class.

British Insulated Wire shares are now quoted in their new guise of £1 shares, the ordinary being 3 and the preference 1, equal to 15 and 5 respectively for the previous £5 shares. The ordinary show a rise of ¼ on the old shares. At 3, the yield is 6⅔ per cent. on the money. Babcock & Wilcox declined to 3½; the armament list is firm, with Armstrongs all but 40s. India-Rubber preferences are harder at 7⅞.

Marconi shares went back on the Italian news, the decline being explained by a market humourist as due to the nationality of the famous inventor! This little joke did not amuse the operators, who have been recently buying more than they wanted for investment purposes, and whose pressure to realise lowered the price of the parent shares ¼ to 3 5/16, Americans to 21s. 9d., and Canadians to half-a-guinea. Something of a bull account had been built up in Marconis, and reaction is the invariable sequel to an overdose of buying followed by any kind of disappointing news that affects business generally.

Nothing has occurred to encourage Home Railway stocks, and prices once more display a tendency to sag. Metropolitans shed ¾ to 23¼, and the other Undergrounds are heavy in tendency. There is a mild agitation afoot, calling upon the Government to increase the dividends upon the stocks of the controlled lines at the next payment-time, but we imagine that those who most ardently advocate it cannot seriously suppose the Government will take notice, effective notice, anyway, of the proprietors' claims to higher rates. The electrical railways are, of course, not so directly under the ægis of the Government as the steam companies are, and there is at least a faint chance of the Metropolitan's modest 1 per cent. being improved upon in January.

Cable stocks and shares are very firm, on the issue of the final dividends and reports in respect of the year 1916. The industry has done well out of Government and Press work; the uncertainties of postal correspondence, said the Eastern Co.'s chairman the other day, have caused merchants and others to rely more upon the surer medium of cable communication. Seven of the largest of the cable companies increased their net receipts to an aggregate of £3,589,773, an improvement of £350,000 over the 1915 figures. The Cuba Submarine raised its dividend from 5 per cent. to 7 per cent., the Western from 7 per cent. to 8 per cent., and the Great Northern from 22 per cent. to 24 per cent.

The Eastern Telegraph owns, or leases, 46,638 miles of cables and 3,950 miles of land lines. The "China" has 27,258 miles of cables and various working agreements with other companies. The Great Northern owns 8,000 miles of cables, the Indo-European 3,800 miles, and the Cuba Submarine 1,600 miles. The Great Northern Co.'s report illuminates some of the difficulties of present-day working. "Nearly all the cables," says this report, "belonging to the company in Europe cross the continually expanding minefields and prohibited areas, and should breaks occur in such places it may prove impossible to have the cables repaired." There must be plenty of material, one would suppose from the recent cable reports and meetings, for a book to be written on the danger and romance of cable work in war-time.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Oct. 30, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	9	8½	—	£6 18 6
Charing Cross Ordinary	5	5	4	+ ¼	6 5 0
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	4	3	2⅝	—	5 9 1
City of London	8	8	13	—	6 3 1
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5½	—	5 14 3
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3½	—	5 6 3
Metropolitan	3	3	3½	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3⅝	—	7 4 0
St. James' and Pall Mall	7	7	7	—	5 14 6
South London	5	5	5	—	6 13 4
South Metropolitan Pref.	7	7	21/8	—	6 10 8
Westminster Ordinary	7	7	6½	—	5 3 3
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98xd	—	6 2 3
do. Def.	3½/8	1½	33⅛	—	5 9 0
Chile Telephone	5	5	7⅛	—	5 11 4
Cuba Sub. Ord.	5	7	8⅞	—	*3 0 0
Eastern Extension	8	8	14⅛	—	*5 7 7
Eastern Tel. Ord.	8	8	149½	—	*5 7 0
Globe Tel. and T. Ord.	7	7	13⅝	—	*5 5 5
do. Pref.	6	6	10⅞	—	5 15 9
Great Northern Tel.	22	24	89	—	6 8 1
Indo-European	13	13	82½xd	—	5 8 10
Marconi	10	15	2⅞	— ¼	4 11 0
Oriental Telephone Ord.	10	10	8⅞	—	5 2 6
United R. Plate Tel.	8	8	6½xd	—	*5 18 6
West India and Pan.	6d.	6d.	1/16	—	*3 9 6
Western Telegraph	7	8	15	—	*5 6 8
HOME RAILS.					
Central London, Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	23¼	— ¾	4 5 1
do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	13	—	Nil
do. do. "A"	Nil	Nil	6/8	—	Nil
do. do. Income	6	4	84	—	*4 15 3
FOREIGN TRAMS, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 3 4
do. 2nd Pref.	5½	—	2½	—	—
do. 5 Deb.	5	5	67½	—	7 8 3
Brazil Tractions	4	4	44	—1	—
Bombay Electric Pref.	6	6	93	—	6 4 8
British Columbia Elec. Ry. Pfce.	5	5	40½	—	12 6 10
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	51	—	8 16 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	45½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	39	—	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	Nil	40½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	5½	— ½	4 16 0
British Aluminium Ord.	7	10	12	—	6 3 1
British Insulated Ord.	17½	20	8	+ ½	6 15 4
British Westinghouse Pref.	7½	7½	2⅛	—	5 2 0
Callenders	20	20	14xd	+ ⅛	6 16 0
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	22	8/16	—	6 8 0
Edison Swan, fully paid	—	—	2½	+ ½	Nil
do. do. 4 per cent. Deb.	4	4	74⅛	+1	5 7 5
Electric Construction	7½	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	10½	—	5 14 3
do. Ord.	15	15	18	—	5 11 0
Henley	25	25	15½	—	7 18 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	14	—	*7 2 10
Telegraph Con.	20	20	40	—	*5 0 0

* Dividends paid free of income-tax.

Exports and Imports of Electrical Goods during July, August and September, 1917.

The official returns of electrical exports and imports for the months of July, August and September, which we publish below, show, as regards the exports, totals of £394,339, £393,882 and £288,956 respectively, which compare with the three preceding months as follows:—April, £308,514; May, £346,317; and June, £367,520. It will be noted that the values have been well maintained, except as regards September, when machinery, telegraphic and telephonic values fell off considerably.

Electrical machinery exports had up to September shown an upward tendency for some months, the values recorded being well up to last year's average values, despite the difficult conditions introduced by the war: the August exports of telegraphic material included some £15,500 worth of submarine cable. The electrical import values for the three months under review were:—July, £218,741; August, £179,994, and September, £210,237, which compare with totals of £235,985 in April, £236,799 in May, and £186,888 in June, and show, if anything, a falling-off in value. It will be noted that lamp imports attained only small values during the months referred to, but battery imports have shown a considerable advance in value.

The re-exports of foreign and colonial electrical material fluctuate considerably in value, and attained a fairly high level in September.

The figures for the past seven months, up to and including September, have been as follows:—

March, £17,795; April, £13,262; May, £17,403; June, £14,927; July, £13,757; August, £13,851, and September, £27,522. These figures compare with a monthly average of, roughly, £16,000 during the years 1915 and 1916.

Exports and Imports of Electrical Goods and Machinery, July, August and September, 1917.

	July.			August.			September.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£34,225	£49,896	£2,775	£78,942	£44,938	£4,466	£71,300	£52,407	£1,335
Insulated wire and cable (not telegraphic or telephonic)	24,349	4,022	5,681	34,381	3,327	3,662	21,138	1,429	14,629
Electric glow lamps	10,101	3,035	1,337	11,324	805	233	9,638	160	116
Arc lamps and parts (not carbons)	15,256	5,484	68	15,123	17,234	2,334	17,449	5,600	—
Meters and instruments	17,406	5,540	645	13,556	790	475	7,115	2,913	146
Electrical machinery (including switchboards ∞ and transformers)	155,615	119,207	2,430	148,108	82,676	2,180	110,938	115,694	1,053
Batteries	6,008	24,048	47	15,106	23,886	20	11,911	20,128	—
Carbons	1,190	2,294	136	4,292	3,203	63	700	8,323	—
Telegraph and telephone wire and apparatus...	130,189	5,215	638	73,050	3,135	418	38,767	3,583	10,243
Totals	£394,339	£218,741	£13,757	£393,882	£179,994	£13,851	£288,956	£210,237	£27,522

THE HIGH-TENSION MAGNETO.*

(*Concluded from page* 406.)

The Design of Aeroplane Magnetos.

Reliability.—In the case of an aeroplane magneto, this is a consideration of primary importance, because failure of the magneto may mean sudden destruction of the machine and pilot. An aeroplane type of magneto should be most carefully and rigorously tested before it leaves the manufacturer. During this test the strain put upon the machine, both mechanical and electrical, should be greatly in excess of the maximum strain likely to obtain under abnormal working conditions. These fundamental considerations were carefully borne in mind when arranging the series of tests to be imposed upon the type "A" magneto.

In the case of the armature, extraordinary precautions were taken—first, by carefully inspecting all the insulating material and each reel of enamelled wire, and secondly, by subjecting the finished armature to a prolonged electrical test with the secondary discharging at 9,500 volts between electrodes. In addition to this, the armature is inspected several times at various stages of the winding and finishing process.

Every magneto is subjected to running tests as follows:—

1. Run for 20 hours at 2,500 R.P.M. at air temperature, with each distributor terminal connected to a spark gap adjusted to discharge at 7,500 volts.

2. Completely dismantled and the various metal parts cleaned in petrol. Magneto then reassembled and adjustments made where necessary.

3. After re-magnetising, magneto run for four hours at 2,500 R.P.M., with spark gaps as under (1), in a hot box with air at 100 deg. F.

4. At the end of this final run the magneto is tested at low speeds to ensure that the sparking characteristics are satisfactory.

5. Before shipment, the magneto is inspected in every detail, all adjustments are carefully checked, and screws tightened and locked where necessary.

Weight.—It is obviously desirable to keep the total weight of an aeroplane type magneto as low as possible. To do this, it is first necessary to develop a design that requires a minimum volume of material, and secondly, to use, if possible, aluminium castings. Special steels should also be used wherever possible, so that the required strength can be achieved with a minimum weight of material.

Die castings made of an aluminium-copper alloy containing no zinc are to be preferred to sand castings, because the general appearance of the magneto is enhanced thereby, and the amount of machining that has to be performed on the parts is very considerably reduced. Furthermore, the metal is much tougher, and the threads in tapped holes are not so likely to become stripped when the screws are securely tightened.

Elimination of Fire Risk.—This is of vital importance, because any sparking within the magneto may, under operating conditions, be the means of initiating a fire by igniting a mixture of air and petrol in the surrounding medium. Tests were carried out by the N.P.L. in the early days of the war to determine the extent of this danger. A number of different types of pre-war Bosch magnetos were run in a chamber that could be filled with an explosive mixture of air and petrol. Generally speaking, it was found that explosions were likely to occur as a result of:—

(1) A succession of sparks at the safety gap.

(2) Sparks between distributor segments or other high-tension parts, and the frame of the magneto.

(3) Sparks at the contact-breaker points.

Trouble is most likely to arise from cause (1), although this was eliminated by enclosing the safety spark gap in a fine mesh gauze casing on the principle of the Davy safety lamp, so as to prevent any explosion in the immediate vicinity of the safety gap electrodes being propagated in the surrounding medium.

Trouble due to causes (2) and (3) can be eliminated by careful attention to the design of the magneto to prevent any wasteful sparking of this nature. In the type "A" magneto this is done, whilst the safety spark gap is contained in a separate gas-tight chamber fixed underneath the distributor and provided with a ventilation hole covered with a piece of very fine mesh gauze. As a "spark-gap" type of distributor is used, it is necessary to provide some form of ventilation so that the products of ionisation can escape. Here again the ventilation hole in the front of the distributor is covered with a piece of fine mesh gauze, and the whole combination is thus perfectly safe. Very severe tests carried out on this particular machine, by introducing an explosive mixture of coal-gas and air into the contact-breaker housing, safety-spark-gap chamber, and distributor, have quite confirmed this view that the risk of fire under operating conditions has been entirely eliminated.

In the 12-cylinder polar inductor magneto previously described, the safety spark gap rotates with the distributor brush. This is a distinct improvement upon the stationary form of spark gap generally adopted, because the products of ionisation are churned up and quickly expelled through the ventilation window provided in the front of the distributor. This window is covered with gauze, as in the type "A" machine, which makes the magneto fireproof.

Variable Timing.—Several thousand type "A" eight-cylinder aeroplane magnetos with fixed ignition have been supplied, so presumably on certain types of engines variable ignition is not required.

When starting a petrol engine it is, generally speaking, necessary to retard the ignition so as to prevent the explosive wave in the cylinder being sufficiently propagated before the piston reaches the top of its stroke to produce a backfire.

In the case of an aeroplane engine, the necessity for making such an adjustment should not arise if a hand-starting magneto provided with H.T. switch is used. In view of the fact that the hand starters now being used in this country are not fitted with this special cut-out switch, it seems necessary that some provision should be made either inside the magneto or in the outside drive for an adjustment of this nature. The method of obtaining adjustment of the timing, adopted

* Abstract of paper read by Mr. A. P. Young, A.M.I.E.E., before the Aeronautical Society.

by the Bosch Co. in their pre-war rotating armature type magnetos, was to make provision for rocking the contact-breaker cam housing through a definite angle ranging between 16 deg. and 35 deg. Obviously, any angular displacement of this housing will cause the spark to occur either earlier or later in each cylinder.

The primary current curves clearly prove that at low speeds—when the necessity for retarding the ignition is greatest—any retarding of the spark will greatly weaken its intensity. At high speeds, on the other hand, the reverse is true, and the spark becomes stronger as the timing lever is retarded.

The inherent defect of a H.T. magneto, as ordinarily constructed, can be overcome by providing special sliding poles, which are mechanically connected to the timing lever, so that their position is changed at each adjustment of the timing. A design of this kind is used on one of the Bosch Co.'s latest magnetos, developed since the outbreak of war, and it ensures that when the primary circuit is broken, the armature always bears a definite relation to the pole pieces, regardless of the position of the timing lever. In consequence, the current I_B for any given speed will remain constant, and the intensity of the spark will be the same for all adjustments of the timing.

Having overcome one inherent difficulty, the other one associated with the distributor still remains. If we assume that when the timing lever is fully advanced the contact-breaker points close just before the carbon brush leaves the distributor segment—and at very high speeds the H.T. spark will persist until the contacts close—it is clear that with the lever fully retarded the carbon brush will be some distance off the segment when the spark ends. In other words, sparking between carbon and segment will result, which must tend to burn the brush track. This difficulty can only be overcome by designing the contact-breaker cams to give a very short period of open circuit (θ_1), but from other considerations it is undesirable to make θ_1 too small. The difficulties likely to arise in this connection are more pronounced on a 12-cylinder magneto, where the problem of distribution is very complex.

Taking everything into consideration, therefore, the author holds that in the case of an aeroplane magneto, adjustment of the timing should be made outside the magneto and incorporated in the drive by the engine designer. This enables the magneto designer to work out his design on the basis of fixed ignition, and he is thus enabled to simplify the mechanical construction of the machine and arrange matters so that the magneto will give the very best electrical performance over a wide range of speed.

The problem of devising some mechanical method of adjusting the timing that can be incorporated in the magneto drive is not difficult of solution. For example, some form of sleeve working on a coarse thread and capable of movement in an axial direction can be provided for this purpose. On these lines it is possible to develop a scheme whereby both magnetos (in cases where two-point ignition is adopted) can be adjusted in phase by the movement of a single lever. It is also possible to provide for adjustment through a worm spindle operated by a flexible drive terminating in a hand wheel placed in close proximity to the pilot. This latter method would allow of a remarkably fine adjustment being obtained.

Now that a British magneto industry has been established on a sound foundation, it is vitally important that when the war is over this industry should be supplied with the necessary materials used in the construction of high-tension magnetos from within the British Empire. Only in that manner can we secure a truly British-made magneto. Viewed from the national standpoint only, such a course is absolutely essential, because otherwise, in the event of war, this industry, upon which so many other war industries are dependent, will be handicapped for lack of one or more essential materials.

Varnished paper, silk, and cambric are essential to the manufacture of a satisfactory magneto armature, and although they can be purchased in England at the present moment, the greater portion of this material is imported from America. The very fine mesh silk is woven in Japan, and the varnish manufacturer is at the moment depending on supplies obtained from foreign countries.

At the present moment there are several manufacturers in England who are making moulded insulating material similar to the German stabilite, and recent progress has been most gratifying. There seems absolutely no reason to suppose that the English manufacturers will not eventually be in a position to adequately meet all the demand for this class of moulded material, but co-operation between them and the magneto manufacturers is necessary.

The most satisfactory distributor carbon brushes are at the moment being manufactured in France, although one English manufacturer has certainly made very commendable progress. This is another case where hearty co-operation between the brush manufacturer and the magneto manufacturer is necessary if the best results are to be achieved.

It is hoped that the manufacturers of die castings will take steps to ensure that after the war is over the demand for die castings that will be made upon them by English magneto manufacturers will be fully met. The magneto industry would receive considerable assistance if it were possible to purchase brass die castings in large quantities.

In appendices the author gives a detailed analysis of the working of the battery ignition system, and the derivation of a formula which he has developed for computing the primary current in a magneto at "break."

THE TRAINING OF ENGINEERS.

At the Institution of Civil Engineers on Thursday last week an important meeting was held, as briefly mentioned in our last issue, to form a Central Organisation for improvement in and better co-ordination of engineering training. Sir Maurice Fitzmaurice, Pres. Inst.C.E., was in the chair, and the audience included some 75 delegates representing all the engineering institutions and societies connected with the engineering industries, British and Irish Universities, technical colleges and schools, technical teachers, the Board of Trade and other Government Departments, the Dominions, and, of course, the Board of Education, though unfortunately Mr. Herbert Fisher, President of the Board, was unavoidably prevented from attendance. There was also a large number of representatives of manufacturing firms, railways, education committees, the technical Press, and other interests concerned in the questions under consideration.

In opening the discussion, the Chairman expressed the cordial sympathy of the Council of the Institution of Civil Engineers with the movement, and emphasised the great importance of the meeting, which was unprecedented in its representative character. He remarked that no proposal was made to interfere with the existing organisation of any university or society, but he believed that all parties would agree as to the desirability of coming into line with the scheme that would be put forward. The manufacturing industries depended very largely upon engineers, of whom a full supply was necessary; young engineers should be provided with an adequate training, but the means of obtaining the necessary training were not satisfactory at present.

A letter was read from Mr. Fisher, promising the hearty co-operation of the Board of Education in any suitable scheme that the engineering industry might adopt, and Mr. A. E. Berriman, chief engineer of the Daimler Co., who has shared with Mr. A. P. M. Fleming, of the British Westinghouse Co., the preliminary work of organisation, explained in detail the origin and purpose of the proposed organisation, which, he said, must be permanent and representative, must co-operate with the interests concerned, must exert an *active* influence, and, lastly, should be independent of financial assistance from the Government. Mr. Berriman's remarks followed the lines of a memorandum, of which the following is a brief abstract:—

The proposal to form a central organisation originated in an informal conference of engineers and educationists, which held several meetings at the Board of Education during the early months of 1917. It soon became apparent that the amount of useful work to be accomplished was altogether beyond the scope of a temporary conference, and, with the support of the Board of Education, steps were taken to hold a meeting, at which the real need for a Central Organisation might be confirmed and some definite proposal formulated. The broad purpose of the proposed organisation is to provide the engineering industry and profession with a representative brain and articulate voice on educational matters; any such scheme essentially depends on the combined assistance of the various Institutions, not only in creating and in helping financially to maintain the organisation, but in enabling it to perform its functions efficiently through the principle of devolution. Primarily, it will co-ordinate things that exist, and bring them together in conference, so as to avoid overlapping of effort.

There are three objects in particular on which the proposed Central Organisation might usefully concentrate its attention:—

The first is the co-ordination of engineering training, including the fostering of apprenticeship as a national institution, and the consideration of means by which the works period of an engineering pupilage may be increased in efficiency, and a wider appreciation secured for the value in industry of education of university rank.

The second is the maintenance of a central bureau, where parents and educationists can obtain accurate and comprehensive information relating to the engineering industry, and the proper course to pursue on behalf of boys who are desirous of making engineering their profession.

The third is the promotion of scholarships, or other equivalent means by which the best talent may be enabled to rise to its proper level under the stimulus of educational opportunity.

With regard to the first of these objects, co-ordination refers primarily to encouraging a proper relationship between school work and shop work for all classes of engineering students. No plan for extended school work, such as the new Education Bill foreshadows, can possibly bear its full fruit unless it is supported by a workshop instruction that is effective in fitting a boy to make the best of his future manhood, and no training for engineering management can hope to be

efficient unless the clear thought that it confers by higher education is coloured with the human sympathy and understanding that is born of personal experience in the shops among the men. Nor is it only a vocational training that has to be considered. It were short-sighted indeed to overlook the citizen and the man in trying to make the mechanic, or to forget the importance of good health and the value of a mind with many interests.

Incidentally, there is a widely recognised need for encouraging lads to become apprentices as distinct from mere members of the vast community of child labour, and this recognition extends also to the need for effecting improvement in the educational value of the works period of engineering training, whether it be for the apprentice who seeks to learn a man's skilled trade, or for the pupil who is qualifying for ultimate positions of management.

That the time is ripe to bring into existence a central organisation to which engineering firms and others could apply for information relating to apprenticeship systems and methods of training that are actually in operation, may be judged from the number of letters in support that have been received from various sources, and as to any further need for an information bureau (the maintenance of which is the second of the specified objects of the organisation), the answering of the daily letter from the perplexed parent whose son is approaching the completion of his last term at school, may in itself seem to be sufficient justification to the many engineers who would be relieved thereby from the onus of replying to this mass of correspondence. As a link by which parents, schools, and universities are enabled to get into direct touch with the engineering industry and profession, the proposed Central Organisation will be performing one of its most important *rôles*.

The need for making the most of those who do enter engineering is equally vital, and leads logically to the inclusion of the third of the above-mentioned objects of the organisation. Without doubt, much potential talent is prevented from developing either as quickly or as widely as it could through lack of financial assistance, and it would be a worthy endeavour on the part of the engineering world to attempt some improvement in this direction by fostering the establishment of proper scholarships, and forming a new "educational ladder," which many hope to see extend from the bench to the university for those boys, irrespective of social distinction, who are able to climb thus high. Some widening of view is still needed to obtain a general appreciation of the university standard of education as an asset of real value in practical life.

In the course of the discussion which followed, Sir Dugald Clerk stated that highly trained men were not even yet easily placed in works; employers objected to having men in their works for a time who would go away and carry their information elsewhere. It might be necessary to invoke the aid of legislation to meet this difficulty.

Mr. Michael Longridge, Pres. I.Mech.E., expressed the hope that the manufacturing engineer would support the scheme, as its success depended very largely on his attitude towards it. Increased output was the only means of meeting the high working expenses after the war, and could be obtained only by increased efficiency and improved education.

Mr. C. H. Wordingham, Pres. I.E.E., gave whole-hearted support to the proposal, and said that the keynote was co-ordination of existing resources and co-operation of existing institutions. All petty jealousies must be sunk in the effort to achieve success. He believed that the scheme outlined contained the elements of success, and said that if the new organisation could lay down standard methods of training it would accomplish an immense achievement.

Mr. W. H. Ellis (Master Cutler) said that hitherto apprenticeship had been regarded as a privilege granted to the boy; employers should regard it as a responsibility resting on their shoulders. The ideas now associated with the word "Welfare" embodied his views on the subject.

Mr. H. B. Rowell, Pres. N.E. Coast Institution of Engineers and Shipbuilders, Mr. W. H. Hichens, Chairman of Messrs. Cammell, Laird & Co., and Mr. R. T. Nugent, Director of the Federation of British Industries, gave their support to the scheme.

Prof. W. E. Dalby said that the need of such a scheme was very pressing. Ten years ago he found that in Germany 10,000 well-educated men over 18 were studying engineering, compared with only 900 in this country. The system of training followed by our colleges was as good as any in the world; the main consideration was to build a solid foundation on which any edifice of specialised knowledge could be erected. The pernicious premium-pupil system was dying out; they should pay the apprentice a living wage.

Lieut.-Comdr. C. F. Jenkin said that the scholarships should be provided by the manufacturers, who should take broader views and admit their responsibility for carrying on the education of the boys after they left college.

Sir A. Selby Bigge, of the Board of Education, welcomed the scheme, and laid stress on the necessity of co-ordinating the training with the use to which it would be put in after-life.

Sir Wilfrid Stokes, President of the British Engineers' Association, gave hearty support to the scheme, which, he pointed out, was evidently approved by the meeting. Out of the 26 members of the proposed committee, he saw that 11 would be manufacturers, and was quite content to leave details to the committee.

Sir John Wolfe Barry then moved the resolution appointing a committee representative of 21 engineering societies and associations, the Board of Education, the Headmasters' Conference and Association, the Association of Technical Institutes, and Universities and Technical Colleges—26 in all, with power to add to their number—to initiate means to give effect to the principle of a Central Organisation.

Dr. W. H. Hadow seconded the resolution, which was carried unanimously.

Mr. A. H. D. Acland, former Minister of Education, afterwards stated that Mr. Fisher would probably very soon bring in a scheme of Government scholarships as a matter of urgency, involving an annual grant of £100,000 to schools, £100,000 for maintenance scholarships, and a still larger sum for continuation scholarships at the universities.

REVIEWS.

Predetermination of Prices. By Frederic A. Parkhurst, M.E. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The author deals with the fundamental factors which govern the possibility of determining true costs, and his treatise is one of scientific commercial management and research. He describes largely foundry costs, but also deals with his subject generally, and in the preface states that he describes no untried theories, but that each result has been thoroughly tested by actual use, and that nothing unproved has been recorded.

Chapter I emphasises the importance of "absolute control of all sources of information," whether a simple system for a small business, or for one involving many departments and a large variety of products. He states truly that it is of no use to know when the job is finished that it "cost too much," we want to know "the cost in advance." A diagram showing the relation of true costs to profit and selling prices is interesting.

Chapter II is a discussion of elements affecting true costs. The author deals with this in a very lucid manner, and the reviewer is pleased to see the importance he attaches, *inter alia*, to:—(1) Order groups, amongst which he deals with additions or betterments to buildings, plant, &c., or, in other words, increment of capital assets. The importance of this must be acknowledged inasmuch as capital charges and maintenance are increased, therefore there is a corresponding expenditure to account for, a fact that may be overlooked in dealing with hourly rates, especially when capital charges are assessed at their valuation for the previous year ending. (2) Stores keeping and perpetual inventory. This is one of the important items in the managerial control of costing. The author's illustration—"stores card"—shows a perpetual balance, a danger limit, and the prices. The importance of price on a stores quantity card is in very many cases ignored; that it is a factor in true costing will be acknowledged when it is considered that the same class of goods may be purchased at different rates, hence, with the prices on the card, when one lot of goods is issued, the new rate is apparent for the purpose of recording the true cost of the material. (3) Bonus incentive. The author's remarks that the realisation of maximum efficiency should be recognised by a remuneration over and entirely separate from the prevailing rate of wages, will be admitted to be true.

The diagrams are straightforward, but a number of them in this and subsequent chapters are on folded sheets. In the reviewer's opinion this is a mistake, as books of this nature are usually handed round, and folded sheets become torn and parts are eventually lost; it is far better to continue diagrams from page to page until the form is finished, and it is just as easily understood. Further, the reviewer is rather surprised that more advantage is not taken of loose-leaf books for columnar work, as on a single sheet the number of columns is limited, and the book is very often large and unwieldy, whereas with the loose-leaf book columnar work is practically unlimited, and the cross additions can be shown on each page if required, but it is usually only necessary to have total cross additions on the last page of the continued form; moreover, quite a number of relative forms, summaries, &c., suitably sub-divided, can be kept in the one book, thus the data are centralised.

Chapter III describes the elements entering into direct costs, and chapter IV analyses the rather intricate problem of indirect expense, showing the use of various expense symbols in connection therewith, and discussing departmental expense distribution. The section dealing with "distribution of burden" is decidedly interesting. In a section on "Erroneous Methods of Distributing Indirect Expense," the author describes methods adopted that are incorrect, and the curve, fig. 17, graphically illustrates the error existing in a flat-rate method of distributing burden. The concluding chapters are "Recapitulation of Costs," "Estimating," "Profit and Relatively True Selling Prices," all of which the author deals with in a highly instructive manner, and in his closing remarks he states that we no longer associate lowest costs

with least output in wages, but that modern striving for low costs under proper and scientific management pays the highest wage, and has resulted in the improvement in a marked degree of working conditions.

The book will undoubtedly be a valuable addition to the managerial library, and the time taken in the study of this work will be time well spent by all interested in the scientific commercial arrangement of manufacturing undertakings, large or small.—J. C. P.

Hydro-Electric Power. By LAMAR LYNDON. Vol. I, Hydraulic Development and Equipment." London: Hill Publishing Co. Price 21s. net.

The details of hydro-electric power development are treated in a masterly fashion, the data and illustrations referring chiefly to water-power practice in the United States of America.

The volume commences with consideration of the factors which must be investigated before deciding whether a water-fall should be harnessed. The advantages of high-head falls over those of low heads are emphasised.

Formulæ are given for the determination of horse power, and it is pointed out that when calculating power it is usual to take the weight of a cubic foot of water at 62½ lb. In tropical countries, however, this is too much, because water at a temperature of 100 deg. F. weighs only 62.06 lb.

It appears that in the States the power companies have two ways of charging. The first, called primary power, is a contract for supply all the year round, regardless of fluctuations of stream flow. The second, called secondary power, is usually guaranteed for only nine months in the year, and the charge for this is, naturally, at a much lower rate.

Diversity factor, defined as the ratio of the maximum connected load to the maximum station output, is stated to range from 1.5 to 2.0.

Pipe Lines.—The diameter of the smallest size pipe to deliver a given amount of power is that in which the loss of head in the pipe is 0.351 of the total head. Under the condition of delivery of maximum power, such a pipe-line would give only 64.9 per cent., which is much too low for any condition, except where only a limited amount of power is required from a fall, and where the pipe line is very long. It is pointed out how a pipe line may collapse inwards by a too rapid opening of the water-wheel gates, allowing the water column in the inclined section to accelerate rapidly and thus cause a separation of the lower portion from the upper and only slightly inclined portion, which cannot accelerate so quickly.

The advantages of wooden stave pipes over steel plate pipes are stated to be:—(*a*) The low first cost, (*b*) ability to act as a heat insulator and prevent freezing, (*c*) not so subject to injury from settling or expansion and contraction, (*d*) can be quickly repaired with material easily obtained, (*e*) the friction loss is less than with steel, (*f*) the loss does not increase with time, (*g*) the materials of the pipe are light and easily transported. The life of a stave pipe depends more on the durability of the timber than on the bonds. Only in rare instances have bonds failed first.

Dams.—The design and construction of dams are gone into very thoroughly, and they are stated to be of three types:—(1) The gravity dam, in which weight of material resists the water pressure, (2) the hollow dam, having an inclined up-stream face, (3) the arch or cambered dam, which in plan is curved and acts as an arch. In this form the pressure of water is resisted by the arch action, and it is therefore necessary to have unyielding walls at each end to resist the stresses transmitted to them. An illustration is given of the Halligan arched dam, which is 62.3 ft. high at the crest of the spillway section, and 350 ft. long, the chord length being only 334 ft.

Water Wheels.—Under the heading "Impulse Wheel or Pelton Wheel," there is a discussion of various methods of regulation. Where constant speed is required, and changes in power delivered to the wheel must be quickly effected, a combination of needle-nozzle and of jet deflection is sometimes employed. A modification of the deflecting nozzle due to the Allis-Chalmers Co. is shown, this having its moving portion and centre of oscillation near the discharge end of the pipe.

The last chapter deals with speed regulation of water wheels and abnormal penstock pressures, and also gives very valuable information on such matters as (*a*) time periods of governors, (*b*) water hammer, (*c*) relief valves, (*d*) surge tanks, (*e*) pipe vents, (*f*) water wheel governors.

There are occasional repetitions of statements, conclusions, and of the meanings of symbols, but this is done for the purpose of making any single chapter complete in itself. Books of this character are seldom read through consecutively, and it wastes the reader's time and patience to search through other parts of a book for meanings.—E. K. S.

New South Wales Collieries.—The Government of New South Wales has commandeered all the coal mines in the State; 10 mines are being worked and have been manned through the National Service Bureau, which was opened for the enrolment of voluntary labour at the end of August.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,884. "Magnetophones and alternating-current electric generators with oscillating fields." F. T. CHAPMAN. October 15th.

14,893. "Portable electric grinder." A. H. STEED & L. W. WATSON. October 15th.

14,896. "Sparking plugs." W. H. PEASE. October 15th.

14,899. "Sparking plugs." A. E. LAMKIN. October 15th.

14,908. "Electromagnetic friction clutches for driving and change-speed gear for motor vehicles, &c." MEPCO-ELMA SYNDICATE & G. POLLARD. October 15th.

14,918. "Electric lamp fittings." A. J. BONNELLA. October 15th.

14,932. "Electrically-heated steel furnaces." J. L. DIXON. October 15th. (U.S.A., October 14th, 1916.)

14,933. "Electric steel furnaces." J. L. DIXON. October 15th. (U.S.A., October 14th, 1916.)

14,936. "Electric switches, &c." P. L. TEED. October 15th.

14,969. "Magnetically-operated devices for contact making, indicating, or registering." P. W. PAUL. October 16th.

14,976. "Controlling X-ray tubes." F. D. OWEN-KING & G. PEARSE. October 16th.

14,981. "Continuous-current dynamos." F. KESSELRING. October 16th.

14,991. "Electric accumulators." H. F. JOEL. October 16th.

14,992. "Troughs for electric cables, &c." CALLENDER'S CABLE & CONSTRUCTION CO. AND F. E. WORDSELL. October 16th.

14,999. "Protective devices for electrical cables or cable systems." F. F. P. BISACRE AND MERZ & MCLELLAN. October 16th.

15,010. "Sparking-plugs." J. E. BARROWS. October 17th.

15,040. "Electric adapters, &c." N. MCLEAN. October 17th.

15,069. "Sparking plugs for internal-combustion engines." L. S. CLARKE. October 17th.

15,076. "Grids for storage batteries." E. F. ABLITT & A. J. ADAMS, AND B. DE Q. QUINCEY. October 17th.

15,097. "Electric furnaces for smelting and refining steel." J. S. ROMANES. October 18th.

15,111. "Boxes and switches of electrical fuses." G. O. DONOVAN, E. W. DONOVAN & L. F. DOUGLASS. October 18th.

15,172. "Electric lamp." S. CLIFFORD. October 19th.

15,176. "Insulations for high-tension electric instrument transformers, also applicable to electric-circuit protective gears." C. S. SARKAR. October 19th.

15,204. "Machine switching telephone system." F. R. MCBERTY, L. POLINKOWSKY & WESTERN ELECTRIC CO. October 19th.

15,205. "Electric connections." W. H. EDWARDS & H. LUCAS. October 19th.

15,210. "Electrically-heated soldering iron." E. CARETTA. October 19th.

15,213. "Sparking plugs for internal-combustion engines." F. L. VARTY. October 19th.

15,214. "Electric lamps." W. A. S. HELLYAR. October 19th.

15,219. "Electrical fittings." L. MILNE. October 19th.

15,228. "Electric time relays." A. ENGLEHARD & SOC. AUTOMATISME ET APPAREILLAGE. October 19th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

5,319. CONSTRUCTION OF SPARKING PLUGS. V. Pons. May 14th, 1915. (100,482.)

9,172. DIFFERENTIAL BEVEL GEARING FOR USE IN ELECTROMECHANICAL VARIABLE-SPEED MECHANISM. J. G. P. Thomas & Thomas Transmission, Ltd. June 29th, 1916. (109,816.)

9,263. ELECTRIC REGULATORS OR RHEOSTATS. Vickers, Ltd., & R. L. Halstead. June 30th, 1916. (109,818.)

13,429. ELECTRIC GENERATOR LAMPS. H. R. van Deventer. September 21st, 1916. (109,826.)

13,488. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co. and B. B. Johnson. September 22nd, 1916. (109,829.)

13,489. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co., F. M. Ward, L. C. Bygrave & H. J. Herink. September 22nd, 1916. (Patent of addition not granted.) (109,830.)

13,725. COMBINED SWITCH AND PLUG BOXES FOR ELECTRIC CIRCUITS. J. Scott. September 27th, 1916. (109,842.)

13,754. ELECTRIC COOKING AND LIKE HEATING APPARATUS. A. F. Berry. September 27th, 1916. (109,844.)

13,812. ELECTROMAGNETIC ENGINE. E. Bachelet. September 28th, 1916. (109,847.)

14,629. MAGNETIC SEPARATORS. A. F. Hallimond & W. G. Fletcher. October 14th, 1916. (Cognate application, 5,054/17.) (109,857.)

15,213. MINE SIGNALLING APPARATUS. R. W. Hall & D. Pearse. October 26th, 1916. (109,862.)

15,607. ELECTRIC FUSES. H. H. Baker. November 1st, 1916. (109,867.)

15,688. WIRE STRETCHING DEVICES. J. S. Withers (C. J. H. Penning). November 2nd, 1916. (109,869.)

15,692. COMPOSITIONS OF MATTER, AND PROCESSES FOR MAKING SAME. A. J. Liebmann. November 2nd, 1916. (109,870.)

15,781. PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 4th, 1916. (109,871.)

16,695. ELECTRIC SIGNALLING. H. Green. November 22nd, 1916. (109,886.)

16,969. ELECTRICALLY-OPERATED BELLS. Sterling Telephone & Electric Co. and F. G. Bell. November 27th, 1916. (109,889.)

17,011. CONTROLLING APPARATUS FOR ELECTRIC MOTORS. H. V. James. November 27th, 1916. (109,890.)

17,838. BULKHEAD GLAND. R. W. Sambidge. December 12th, 1916. (109,897.)

18,324. DISTRIBUTION BOARDS FOR AUTOMOBILE VEHICLES. Soc. Anon. pour l'Eclairage Electrique des Vehicules. January 21st, 1916. (109,643.)

18,460. PORTABLE ELECTRIC HOISTING GEAR FOR DISCHARGING BASKETS FROM SHIPS, AND FOR ANALOGOUS PURPOSES. R. J. Davies-Colley. December 27th, 1916. (109,904.)

1917.

502. ELECTRIC CONTROLLERS. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 10th, 1917. (109,910.)

2,940. TRANSMISSION OF SOUND OR LIKE IMPULSES. R. A. Fessenden. May 12th, 1916. (106,268.)

6,952. CONVERSION OF ELECTRIC CURRENTS BY MEANS OF METAL VAPOUR RECTIFIERS FED WITH POLYPHASE CURRENTS. Brown, Boveri et Cie, Akt. Ges. May 18th, 1916. (106,999.)

7,957. ELECTRIC SPARK-GAP PROTECTIVE DEVICES. G. Giles. June 26th, 1916 (106,467.)